

**Area Management Report for the Recreational  
Fisheries of the Southwest Alaska Sport Fish  
Management Area, 1998**

by

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and

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May 2000



## Symbols and Abbreviations

The following symbols and abbreviations, and others approved for the Système International d'Unités (SI), are used in Division of Sport Fish Fishery Manuscripts, Fishery Data Series Reports, Fishery Management Reports, and Special Publications without definition. All others must be defined in the text at first mention, as well as in the titles or footnotes of tables and in figures or figure captions.

Weights and measures (metric)		General		Mathematics, statistics, fisheries	
centimeter	cm	All commonly accepted abbreviations.	e.g., Mr., Mrs., a.m., p.m., etc.	alternate hypothesis	H <sub>A</sub>
deciliter	dL	All commonly accepted professional titles.	e.g., Dr., Ph.D., R.N., etc.	base of natural logarithm	e
gram	g	And	&	catch per unit effort	CPUE
hectare	ha	At	@	coefficient of variation	CV
kilogram	kg	Compass directions:		common test statistics	F, t, $\chi^2$ , etc.
kilometer	km			confidence interval	C.I.
liter	L			correlation coefficient	R (multiple)
meter	m	east	E	correlation coefficient	r (simple)
metric ton	mt	north	N	covariance	cov
milliliter	ml	south	S	degree (angular or temperature)	°
millimeter	mm	west	W	degrees of freedom	df
		Copyright	©	divided by	÷ or / (in equations)
		Corporate suffixes:			
		Company	Co.	equals	=
		Corporation	Corp.	expected value	E
		Incorporated	Inc.	fork length	FL
		Limited	Ltd.	greater than	>
		et alii (and other people)	et al.	greater than or equal to	≥
		et cetera (and so forth)	etc.	harvest per unit effort	HPUE
		Exempli gratia (for example)	e.g.,	less than	<
		id est (that is)	i.e.,	less than or equal to	≤
		Latitude or longitude	lat. or long.	logarithm (natural)	ln
		Monetary symbols (U.S.)	\$, ¢	logarithm (base 10)	log
		Months (tables and figures): first three letters	Jan,...,Dec	logarithm (specify base)	log <sub>2</sub> , etc.
		Number (before a number)	# (e.g., #10)	mid-eye-to-fork	MEF
		Pounds (after a number)	# (e.g., 10#)	minute (angular)	'
		Registered trademark	®	multiplied by	x
		Trademark	™	not significant	NS
		United States (adjective)	U.S.	null hypothesis	H <sub>O</sub>
		United States of America (noun)	USA	percent	%
		U.S. state and District of Columbia abbreviations	use two-letter abbreviations (e.g., AK, DC)	probability	P
				probability of a type I error (rejection of the null hypothesis when true)	α
				probability of a type II error (acceptance of the null hypothesis when false)	β
				second (angular)	"
				standard deviation	SD
				standard error	SE
				standard length	SL
				total length	TL
				variance	Var
<b>Weights and measures (English)</b>					
cubic feet per second	ft <sup>3</sup> /s				
foot	ft				
gallon	gal				
inch	in				
mile	mi				
ounce	oz				
pound	lb				
quart	qt				
yard	yd				
Spell out acre and ton.					
<b>Time and temperature</b>					
day	d				
degrees Celsius	°C				
degrees Fahrenheit	°F				
hour (spell out for 24-hour clock)	h				
minute	min				
second	s				
Spell out year, month, and week.					
<b>Physics and chemistry</b>					
all atomic symbols					
alternating current	AC				
ampere	A				
calorie	cal				
direct current	DC				
hertz	Hz				
horsepower	hp				
hydrogen ion activity	pH				
parts per million	ppm				
parts per thousand	ppt, ‰				
volts	V				
watts	W				

***FISHERY MANAGEMENT REPORT NO. 00-3***

**AREA MANAGEMENT REPORT FOR THE RECREATIONAL  
FISHERIES OF THE SOUTHWEST ALASKA SPORT FISH  
MANAGEMENT AREA, 1998**

by

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May 2000

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## PREFACE

Data contained in this report represent the Division's most recent efforts to upgrade and update fishery statistics useful in describing Southwestern Alaska's sport fisheries. Data contained in this document were extracted from *Statewide Harvest Summaries*, *Survey and Inventory Reports*, and the *Fishery Data and Manuscript Series*. We consider this report to be the most comprehensive information source concerning effort and harvest statistics for the major Southwestern Alaska sport fisheries.



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## SECTION I: MANAGEMENT AREA OVERVIEW

### MANAGEMENT AREA DESCRIPTION

The Southwest Sport Fish Management Area (SWMA) is comprised of the Bristol Bay Sport Fishing Regulatory Area and the southwestern portion of the Arctic-Yukon-Kuskokwim (AYK) Sport Fishing Regulatory Area. Included in the area are all waters and drainages flowing into Bristol Bay north of Cape Menshikof, the eastern shores of Kuskokwim Bay, and the Kuskokwim River from Aniak River downstream to Kuskokwim Bay (Figure 1). Roughly the size of Washington state, the 54,700 square mile management area contains some of the most productive salmon *Oncorhynchus*, rainbow trout *O. mykiss*, Arctic grayling *Thymallus arcticus*, Arctic char *Salvelinus alpinus*, and Dolly Varden *S. malma* waters in the world.

The sport fisheries of this large region are more easily discussed by dividing the management area into four geographic sections: Eastern, Central, Western, and Northwestern (Figure 1). The four sections are based on general habitat types and are somewhat arbitrary. However, for some species such as rainbow trout, the sections represent distinct differences in the character of the fisheries or biology of local stocks.

The Eastern section includes all drainages from the Kvichak River to the area's southern boundary at Cape Menshikof. Major federal jurisdictions in the Eastern section include the Lake Clark National Park and Preserve, Katmai National Park and Preserve, and the Becharof National Wildlife Refuge.

The Central section is composed of the drainages entering Nushagak Bay, and is dominated by the Nushagak and Wood River systems. The Wood-Tikchik State Park falls within the Central section boundaries.

The Western section reaches from the drainage of the Kanektok River south to Cape Constantine on the Nushagak Peninsula and contains the Togiak National Wildlife Refuge.

The Northwestern section abuts the northern boundary of the management area and includes the drainages flowing into the south side of Kuskokwim River from the Aniak River downstream to Kuskokwim Bay. Portions of the Aniak, Kisaralik, and Kwethluk rivers of the Northwestern section fall within the confines of the Yukon-Delta National Wildlife Refuge.

Major communities located within the region include Naknek, King Salmon, Dillingham, Togiak, Iliamna, Quinhagak, Aniak, and Bethel. The management area is not linked to the state's highway system, although local roads do provide sport fishermen with limited access near the major communities. Float-equipped aircraft are commonly used to access the area's many remote fisheries.

The Southwest Sport Fish Management Area includes portions of four areas for the purposes of recreational effort and harvest reporting in the mail survey of Howe et al. (1998 and 1999). These are the Kuskokwim area (Area V), the Nushagak area (Area T), the Kvichak area (Area S), and that portion of the Naknek River Drainage-Alaska Peninsula Area (Area R) excluding the saltwater fisheries and freshwater fisheries of Cold Bay and the Aleutian Islands.

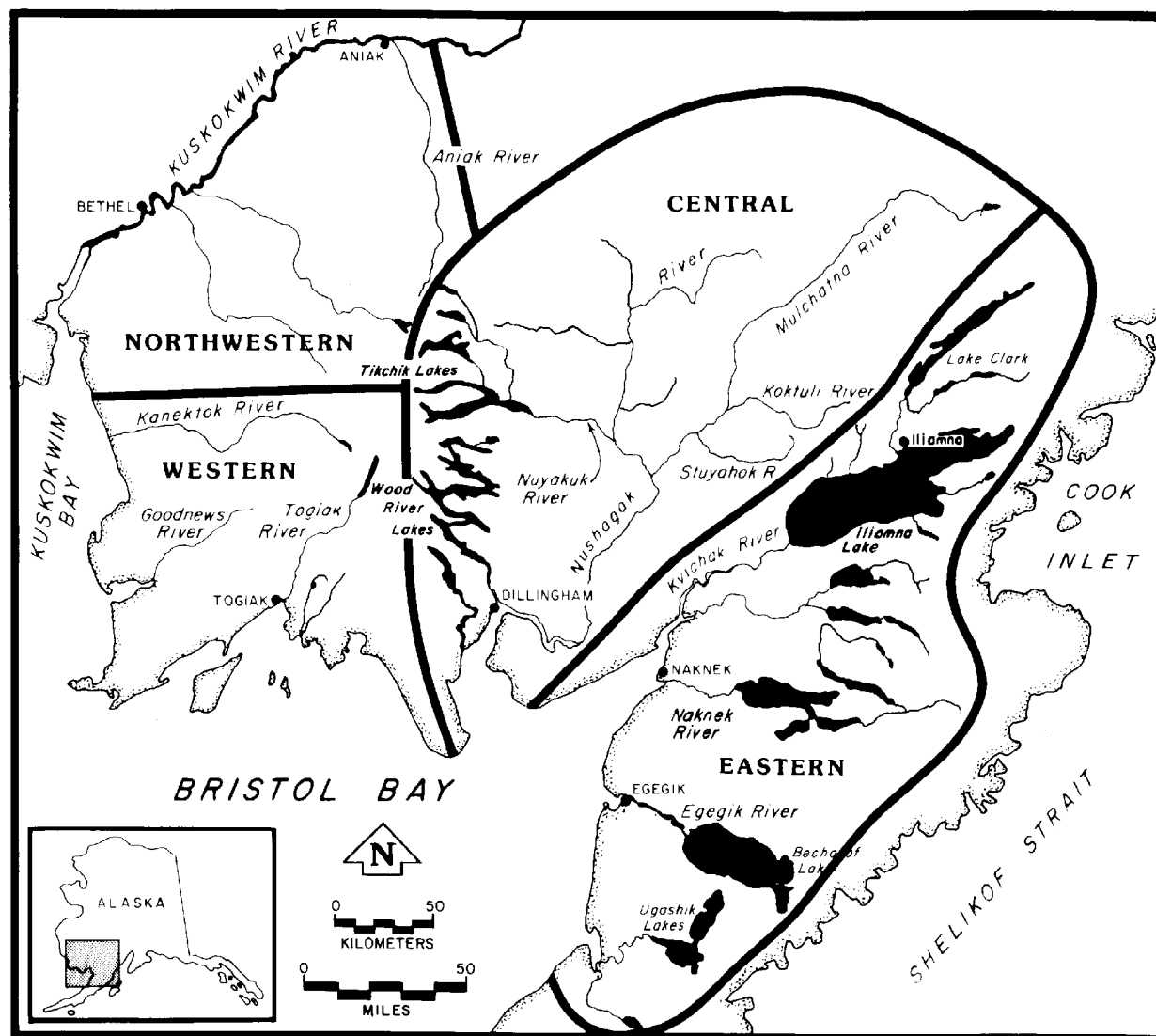


Figure 1.-Southwestern Alaska sport fish management area, showing the Eastern, Central, Western, and Northwestern sections.

## **REGULATORY PROCESS**

The process of developing fishing regulations for fisheries in the SWMA occurs within the established Alaska Board of Fisheries process. Public input concerning regulation changes and allocation issues is provided for in this process through various means including direct testimony to the Board of Fisheries and through participation in fish and game advisory committees. These advisory committees have been established throughout Alaska to assist the Boards of Fisheries and Game in assessing fisheries and wildlife issues and proposed regulation changes in areas that might be affected. Most active committees meet at least once each year, usually in the fall prior to the Board meetings. Staff from the Division of Sport Fish and other divisions often attend the committee meetings. In this way, advisory committee meetings allow for direct public interaction with staff involved with resource issues of local concern. Within the SWMA there are eight Fish and Game Advisory Committees: Lower Bristol Bay, Iliamna, Naknek/Kvichak, Togiak, Nushagak, Lower Kuskokwim, Central Bering Sea, and Central Kuskokwim.

Under the current operating schedule, the Board of Fisheries meets on a 3-year cycle. Proposals regarding the AYK portion of the SWMA were last heard December 2-9, 1997 in Fairbanks. The Alaska Board of Fisheries last met to consider sport fish regulations for the Bristol Bay portion during a meeting held in King Salmon and Naknek during November 4-14, 1997.

The Board of Fisheries is next scheduled to review regulation proposals for Bristol Bay and AYK in the fall or winter of 2000/2001. The deadline for submitting proposals for these meetings is April 10, 2000.

## **RECREATIONAL ANGLER EFFORT**

Beginning in 1977, recreational angler effort has been estimated statewide using a mail survey (Appendix A) (Mills 1979-1994, Howe et al. 1995-1999). This survey estimates the number of angler-days of sport fishing effort expended by recreational anglers fishing Alaskan waters, as well as the harvest of important sport species. The survey is designed to provide estimates of effort and harvest on a site-by-site basis but is not designed to provide estimates of effort directed toward a single species. Beginning in 1990, the survey was modified to include estimates of catch (release plus harvest) on a site-by-site basis (Appendix B). Additionally, creel surveys have been selectively used to ground truth the mail survey for fisheries of interest or for fisheries that require more detailed information or inseason management. The following summary of recreational angler effort in the SWMA is based on the mail survey data.

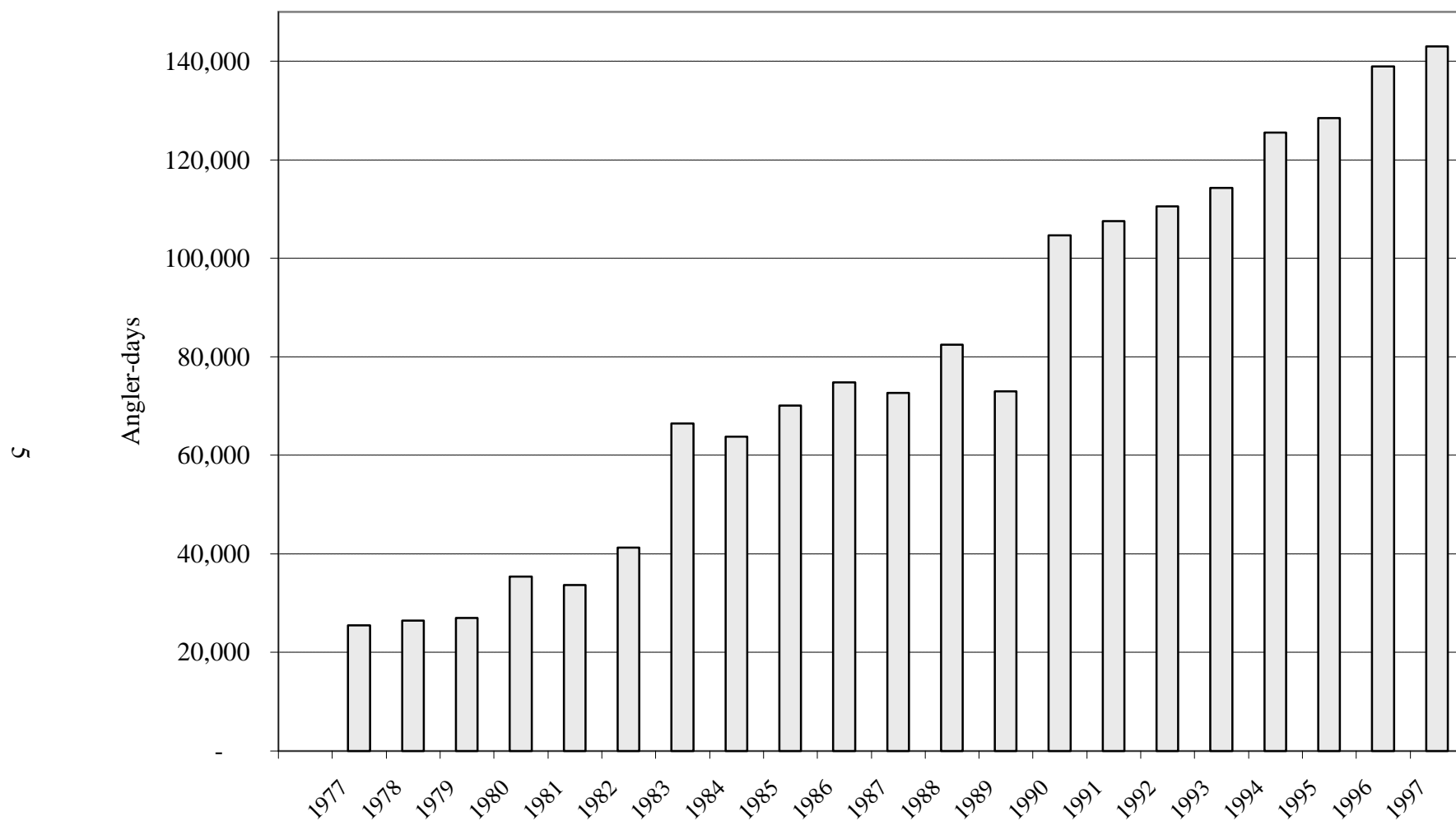
Recreational angler effort in the SWMA rose gradually from 1977 to 1982, increasing from 25,500 angler-days per year in 1977 to 41,300 angler-days per year in 1982 (Table 1, Figure 2). In 1983, recreational angler effort rose significantly to 66,500 angler-days, an increase of over 50% from 1982. A period of relative stability followed, from 1983 to 1989, with recreational angler effort averaging 71,900 angler-days per year. Recreational angler effort again jumped in 1990 rising to 104,700 angler-days. Since 1990, recreational fishing effort has steadily increased to average 130,061 angler-days for the period of 1993-1997. In 1997, the most recent year for which finalized statewide data are available, SWMA effort of 143,002 angler-days was 7.9% of the Southcentral region effort and 5.4% of the total angling effort in Alaska (Howe et al. 1998). Recreational angler effort is expected to continue to increase at a modest rate for the foreseeable future.

**Table 1.-Sport fishing effort for the Southwest Alaska Management Area by section, 1977-1997.**

Year	SWMA Days <sup>a</sup>	Eastern		Central		Western		Northwestern	
		Days	Percent	Days	Percent	Days	Percent	Days	Percent
1977	25,512	17,653	69	7,184	28	675	3		0
1978	26,451	18,912	71	7,000	26	539	2		0
1979	27,022	19,177	71	6,179	23	1,666	6		0
1980	35,358	24,948	71	8,897	25	1,513	4		0
1981	33,715	24,964	74	7,819	23	932	3		0
1982	41,318	30,385	74	9,773	24	1,160	3		0
1983	66,492	43,364	65	16,942	25	3,251	5	2,935	4
1984	63,818	39,394	62	11,160	17	11,732	18	1,532	2
1985	70,108	47,138	67	11,812	17	10,377	15	781	1
1986	74,801	50,724	68	12,026	16	10,232	14	1,819	2
1987	72,730	43,262	59	14,132	19	12,909	18	2,427	3
1988	82,408	40,987	50	19,840	24	18,767	23	2,814	3
1989	73,041	38,460	53	19,677	27	7,638	10	7,266	10
1990	104,699	60,371	58	28,714	27	10,807	10	4,807	5
1991	107,584	56,695	53	38,690	36	6,155	6	6,044	6
1992	110,517	69,310	63	26,621	24	7,842	7	6,744	6
1993	114,300	69,799	61	30,497	27	7,774	7	6,230	5
1994	125,603	67,836	54	40,769	32	10,904	9	6,094	5
1995 <sup>b</sup>	128,466	73,779	57	37,531	29	9,926	8	7,230	6
1996 <sup>b</sup>	138,934	68,912	50	44,849	32	14,740	11	10,433	8
1997 <sup>b</sup>	143,002	73,030	51	33,652	24	24,159	17	12,161	9
Avg(77-82)	31,563	22,673	72	7,809	25	1,081	3	0	0
Avg(83-89)	71,914	43,333	60	15,084	21	10,701	15	2,796	4
Avg(90-97)	121,638	67,467	55	35,165	29	11,538	9	7,468	6
Avg(93-97)	130,061	70,671	54	37,460	29	13,501	10	8,430	6

<sup>a</sup> Ang-days = Angler-day; any portion of a day in which one angler fished.

<sup>b</sup> Preliminary data, subject to revision.



**Figure 2.-Sport fishing effort in angler-days for the Southwest Alaska sport fish management area, 1977 to 1997.**

Historically, most of the effort has occurred in the waters of the Eastern section of the SWMA (Figure 3). This area accounted for 57% of the total effort from 1993-1997. The Central section has accounted for the second largest proportion of effort, about 29% of the total effort from 1992 through 1996. The Western and Northwestern sections have accounted for about 8% and 6% of the total effort from 1992 through 1996, respectively. Distribution of effort among sections during 1997 resembled the historic effort distribution with a slight increase in the Western section and a slightly lower proportion in the Central and Eastern sections (Figure 3).

## **SPORT HARVEST**

Recreational harvests of all species in the SWMA rose gradually at a rate of approximately 16% per year from 24,400 fish in 1977 to peak at nearly 98,000 fish in 1994 (Table 2).

Sockeye *O. nerka*, chinook *O. tshawytscha* and coho *O. kisutch* salmon are the most frequently harvested species, with lesser numbers of Dolly Varden/Arctic char, Arctic grayling, and rainbow trout being taken annually (Figure 4). In terms of numbers of fish harvested, smelt *Osmeridae*, which are not highly sought after in Southwest Alaska, were nevertheless the fourth most frequently harvested species (Table 2). This is more likely a reflection of their abundance and a liberal bag limit rather than their desirability as a sport species. The remaining species of pink salmon *O. gorbuscha*, lake trout *S. namaycush*, chum salmon *O. keta*, northern pike *Esox lucius*, whitefish *Coregonus* and *Prosopium*, and burbot *Lota lota*, are all harvested at relatively low levels.

Harvests for 1997 were on par with the recent 5-year averages. Some exceptions were the sockeye salmon harvest which was 75% of the recent average, and the Dolly Varden/Arctic char harvest that was about 40% greater than the average (Figure 4).

## **ECONOMIC VALUE OF THE SPORT FISHERY**

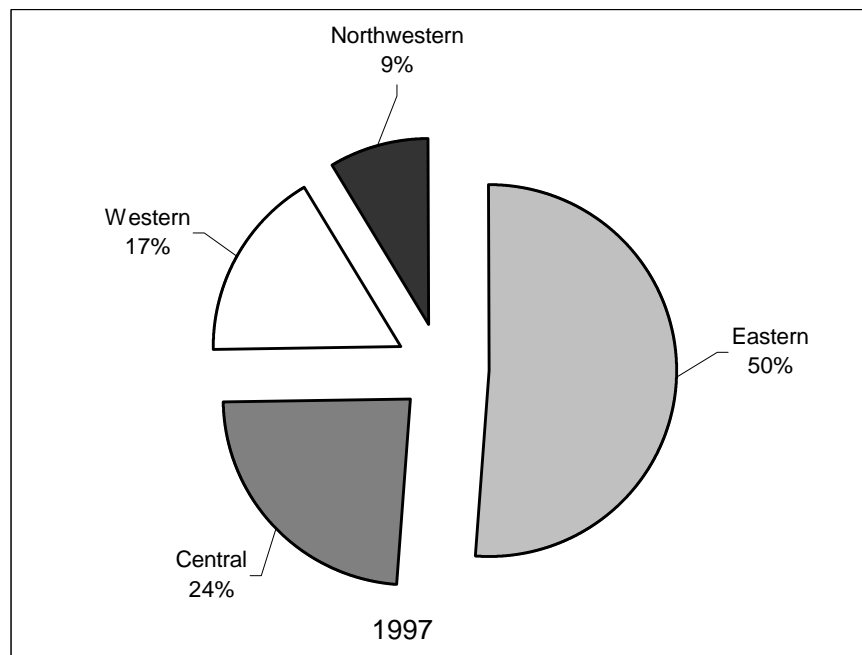
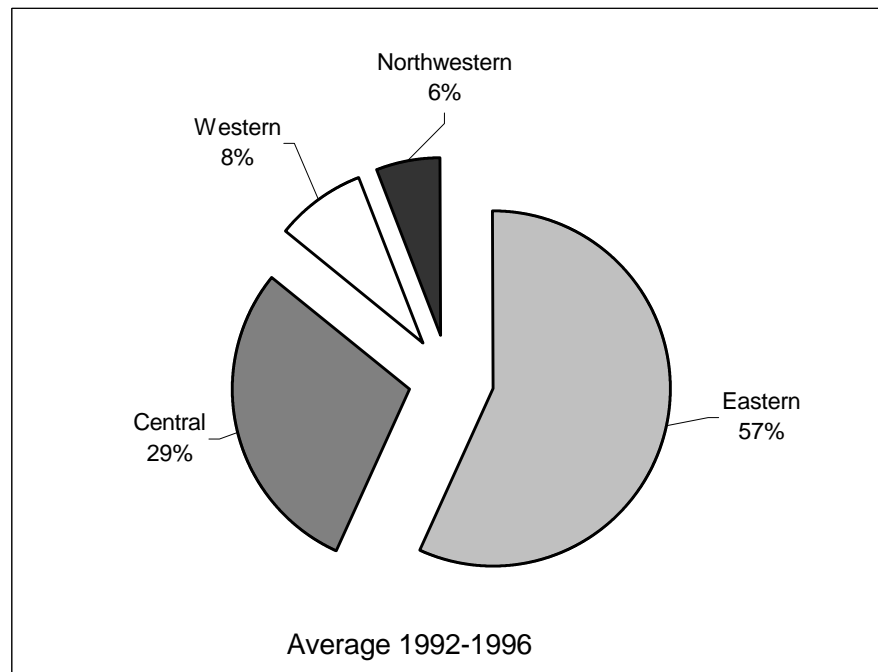
Recreational fisheries in Southwest Alaska provide the angler with a unique combination of high quality salmon and rainbow trout fishing in a pristine wilderness setting. Although this area accounts for a relatively minor portion of the total statewide sport fishing effort, and even less of the statewide harvest, it is the combination of scenery and diverse fishing opportunities that allows this region of Alaska to compete with other world-class sport fisheries. Studies by the University of Alaska placed the 1988 value of the area's recreational fishery at \$50 million (Ackley 1988).

The annual Sport Fish Division budget to manage the \$50 million fishery in the SWMA in fiscal year 1998 was \$535,000 (ADF&G 1999a). Sport fishing effort within the area for calendar year 1997 was 143,002 angler-days, which translates to a cost of \$3.75 per angler-day. Put another way, for every dollar the Division spends on research and management of sport fisheries in Southwest Alaska, about \$100 are potentially added to the economy of the state.

## **MANAGEMENT PLANS AFFECTING FISHERIES**

### **Nushagak Chinook Salmon Management Plan**

Management of the Nushagak chinook salmon fisheries is governed by the Nushagak-Mulchatna Chinook Salmon Management Plan (5 AAC 06.361) which was adopted by the Alaska Board of Fisheries in January of 1992, and amended in January of 1995 and again during the Board of Fisheries meeting in November of 1997. The purpose of this management plan is to ensure an



**Figure 3.-Percentage of sport fishing effort expended in the Eastern, Central, Western, and Northwestern sections, 1992-1996 average, and 1997.**

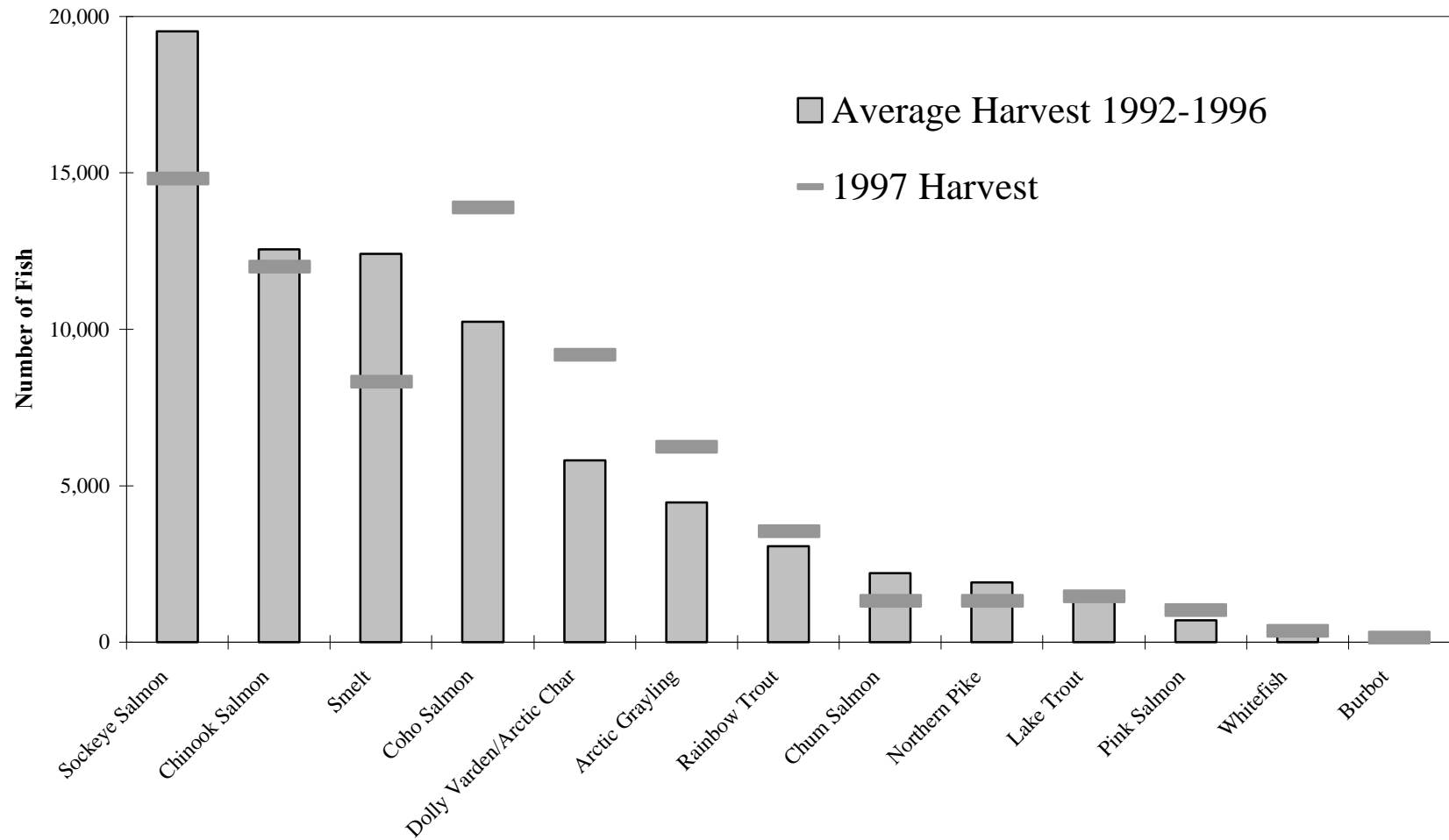
**Table 2.-Numbers of fish harvested, by species, by recreational anglers fishing within the Southwest Alaska Management Area waters, 1977-1997.**

Species	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Smelt	12,064	1,834	65,238	30,764	5,778	14,547	3,902	7,859	18,095	1,284	88
Sockeye Salmon	3,204	4,345	4,403	3,126	3,479	6,417	7,909	7,367	8,445	5,047	10,443
Chinook Salmon	2,003	3,093	3,411	3,649	3,962	5,812	9,272	9,119	9,891	14,599	18,622
Coho Salmon	975	1,476	1,112	2,100	2,303	3,543	5,191	9,005	4,459	13,083	10,424
Dolly Varden/ Arctic Char	1,421	2,731	2,465	4,374	4,481	4,745	10,309	10,666	8,622	5,993	7,979
Rainbow Trout	2,286	2,585	3,318	4,794	5,546	5,085	10,785	7,608	6,607	6,198	6,344
Arctic Grayling	1,963	2,938	3,017	3,952	3,467	5,043	9,029	6,266	5,720	5,493	7,242
Pink Salmon	0	3,286	0	1,299	0	1,142	388	3,253	67	3,629	150
Lake Trout	232	244	635	603	821	576	2,023	1,863	1,072	3,649	2,056
Chum Salmon	148	732	182	147	379	775	1,215	2,051	1,082	1,495	1,252
Northern Pike	123	379	362	276	433	807	2,758	2,848	980	835	2,431
Whitefish	8	25	0	17	183	168	376	287	1,330	958	247
Burbot	0	0	227	0	0	0	189	124	840	355	84
<b>Total</b>	<b>24,427</b>	<b>23,668</b>	<b>84,370</b>	<b>55,101</b>	<b>30,832</b>	<b>48,660</b>	<b>63,346</b>	<b>68,316</b>	<b>67,210</b>	<b>62,618</b>	<b>67,362</b>

Species	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	5 Year Average
Smelt	30,600	57,611	5,640	21,165	22,078	7,458	23,815	8,145	525	8,322	9,653
Sockeye Salmon	8,171	32,962	15,996	17,613	15,912	24,889	20,413	20,250	16,153	14,816	19,304
Chinook Salmon	13,235	13,216	8,875	11,300	10,428	12,651	19,333	12,687	7,678	11,999	12,870
Coho Salmon	12,529	18,535	8,284	9,382	6,676	5,461	10,608	8,229	20,220	13,900	11,684
Dolly Varden/ Arctic Char	6,228	7,482	5,964	7,635	5,717	5,934	5,970	5,065	6,335	9,185	6,498
Rainbow Trout	5,240	4,500	3,779	5,233	3,421	3,161	3,122	2,702	2,956	3,539	3,096
Arctic Grayling	4,212	4,225	3,905	6,750	4,042	4,858	5,971	3,775	3,721	6,252	4,915
Pink Salmon	5,224	827	1,351	625	1,198	251	669	310	1,077	1,032	668
Lake Trout	1,507	3,094	1,617	952	1,355	1,380	2,075	936	1,102	1,469	1,392
Chum Salmon	2,539	4,452	1,734	1,999	2,175	1,802	2,934	1,917	2,172	1,328	2,031
Northern Pike	561	2,133	904	2,500	1,960	1,639	2,427	1,803	1,758	1,316	1,789
Whitefish	217	231	1,538	734	635	557	506	385	78	359	377
Burbot	109	0	1,242	93	169	214	20	0	18	147	80
<b>Total</b>	<b>90,372</b>	<b>149,268</b>	<b>60,829</b>	<b>85,981</b>	<b>75,766</b>	<b>70,255</b>	<b>97,863</b>	<b>66,204</b>	<b>63,793</b>	<b>73,664</b>	<b>74,356</b>





**Figure 4.-Harvest by species of sport-caught fishes in Southwest Alaska, 1992-1997.**

adequate spawning escapement of chinook salmon into the Nushagak-Mulchatna River system. The plan directs the department to manage for an inriver return goal of 75,000 chinook salmon past the sonar site at Portage Creek. The inriver goal provides for: (1) 65,000 spawning fish; (2) a reasonable opportunity for subsistence harvest; and (3) a sport guideline harvest of 5,000 fish. If the inriver chinook salmon return is greater than 75,000, the sport guideline harvest does not apply.

The plan also addresses poor return scenarios by specifying management actions to be taken in subsistence, commercial, and sport fisheries depending on the severity of the conservation concern. If the inriver return of chinook salmon is projected to be less than 55,000 but more than 40,000, restrictions in the sport fishery are mandated; and if the inriver return is projected to be less than 40,000 fish, the sport fishery is to be closed. In 1997, the 55,000 fish “trigger” was adopted after analysis showed this escapement level was not likely to show a difference in the expected productivity versus that expected at the previous trigger of 65,000 fish. In addition, the old 65,000 fish “trigger” had become quite disruptive to the sport fishery.

The 1998 season was the fifth year the department has managed the fishery under some form of this plan. Management is heavily dependent upon the daily estimates of escapement generated from the Commercial Fisheries Division’s Portage Creek sonar site on the Nushagak River.

### **Southwest Alaska Rainbow Trout Management Plan**

In February of 1990, the Alaska Board of Fisheries adopted regulations implementing a comprehensive management plan for rainbow trout in Southwest Alaska. The plan itself was not adopted into regulation but has been recognized as a guiding policy by the Board of Fisheries. The overriding philosophy of the Southwest Alaska Rainbow Trout Management Plan is one of conservative wild stock management (ADF&G 1990). Conservative wild stock management does not necessarily preclude limited harvest of rainbow trout for food or trophies. However, maximum yield principles, which emphasize harvest, are ruled out. Additionally, under a philosophy that emphasizes wild trout management, mitigating losses of wild stocks through enhancement or stocking is not considered a desirable management alternative.

The plan established three policies by which rainbow stocks are to be managed and provides guidance for the Board in developing future regulations.

Policy I: states that native rainbow trout populations will be managed to maintain historic size and age compositions and at stock levels sufficient such that stocking is not needed to enhance or supplement the wild population.

Policy II: states that a diversity of sport fishing opportunities for wild rainbow trout should be provided through establishment of special management areas by regulation. Selection of areas for special management will be based on 11 criteria adopted by the Board of Fisheries. The 11 criteria include: stock status, abundance and size of rainbow trout, history of special management, proximity to local community, legal public access, overlap with freshwater net fisheries, water characteristics, clear geographic boundaries, importance to the sport fishing industry, geographical distribution of special management areas, and unique considerations such as education or research.

Policy III: states that management strategies should be consistent with the prudent economic development of the state's recreational sport fishing industry, while at the same time acknowledging the intrinsic value of this fishery resource to the people of Alaska.

### **Nushagak River Coho Salmon Management Plan**

Management of Nushagak coho salmon stocks is guided by the Nushagak River Coho Salmon Management Plan (5 AAC 06.368), adopted by the Alaska Board of Fisheries in 1996. No changes were made during the 1997 Board meeting. Under this plan the Nushagak coho salmon commercial fishery is to be managed for an inriver goal of 100,000 coho salmon, which provides for a spawning escapement of 90,000; a guideline harvest level of 2,000 in the sport fishery; and a reasonable opportunity in the inriver subsistence fishery. When the projected inriver return falls between 100,000 and 60,000 coho salmon, the sport harvest is not to exceed 2,000 fish. If the inriver return falls between 60,000 and 50,000 fish, the sport fishery is to be closed, and the subsistence fishery restricted. Below 50,000, all coho fisheries close. The department has managed coho returns to the Nushagak under this plan for three seasons. While the direction is clear, the erratic returns of recent years and problems of accurately assessing run size and timing have made it difficult for the staff to implement the plan. As with the chinook salmon plan, inseason management is heavily dependent upon the daily estimates of escapement generated from the Commercial Fisheries Division's Portage Creek sonar site on the Nushagak River.

### **U.S. Fish and Wildlife Service Fisheries Management Plans**

There is a Fisheries Management Plan (FMP) for each of the four National Wildlife refuges (Togiak, Becharof, Alaska Peninsula, and Yukon Delta) that are within the SWMA. These plans generally acknowledge the state's authority for management of the sport fisheries and have little direct effect on the day-to-day management of the area's fisheries. Department staff have worked with U.S. Fish and Wildlife Service (USF&WS) personnel to develop these plans, which are essentially a list of fishery-related issues and concerns and a list of projects to address those concerns. Each plan covers a 5-year period, after which the plan is to be reviewed. The individual plans, along with their effective dates, are listed below:

<u>Refuge</u>	<u>Status</u>	<u>Review Scheduled</u>
Togiak	Adopted	Beginning in 1999 Comprehensive Conservation Plan
Yukon Delta	Adopted	
Alaska Peninsula/Becharof	Draft	Beginning in 1999 Comprehensive Conservation Plan

Department and Service staff have discussed potential changes to the Togiak National Wildlife Refuge FMP but an actual review has not been scheduled.

Adopted in 1992, the Yukon Delta Refuge FMP was implemented gradually over subsequent years. The plan has been adequate and there are currently no plans for revision (John Morgart, USF&WS, Bethel, personal communication).

### **U.S. Fish and Wildlife Service Public Use Management Plans**

The U.S. Fish and Wildlife Service has adopted or drafted Public Use Management Plans (PUMP) for the refuges which address allowable activities. Of significance are the portions of these plans which address commercial sport fishing services. Since most of the sport fishing effort that occurs within refuge boundaries is guided, plans that affect guided access and activities directly affect opportunity to participate in recreational fishing. Generally, these plans establish levels of allowable commercial use on a river-by-river basis. Unguided use levels are not presently limited. The Togiak PUMP is the most complex of the group, requiring operators to submit prospectus applications and essentially bid for the privilege to provide services on these waters (USF&WS 1991).

The Togiak Refuge PUMP was adopted in 1991. Since adoption, four minor amendments have been made. In 1995 review and revision of the plan commenced according to the plan schedule and consistent with the directive to review the plan when unguided visitor use equaled guided visitor use. Department staff have participated extensively with Refuge staff throughout the PUMP revision process. A Draft Public Use Management Plan Revision was expected to be available for public review in 1998. However, the public review was postponed anticipating a 1999 review of the Refuge Comprehensive Conservation Plan (CCP). Further work on the PUMP will be included in the CCP review process. Currently, occasional differences remain between the state and USF&WS regarding management authority as well as the format and wording of some proposed alternatives.

The Alaska Peninsula/Becharof Refuge plans to review, and possibly revise, its CCP beginning in 1999 or 2000. The process may include some review and changes to the fisheries and PUMP plans for this refuge as well. As the process advances, draft alternatives will be provided to ADF&G for review and comment.

<u>Plan</u>	<u>Status</u>
Togiak PUMP	Adopted 2/91; 1998 postponed for CCP
Alaska Peninsula/Becharof	Adopted 2/94; 1999 CCP review commences

### **National Park Service, Alagnak Wild River Plan**

In late fall of 1998, the Park Service expressed its intent to commence a planning effort for the upper 55 miles of the Alagnak River that is designated as a Wild River (Rick Clark, National Park Service, personal communication). The goals of the effort are expected to address human use levels and associated impacts to the resources along the river corridor. The department has been invited to participate when the planning work begins in 1999 or 2000.

### **Nushagak & Mulchatna Rivers Recreation Management Plan**

The Nushagak & Mulchatna Recreation Management Plan was adopted in August of 1990. The plan is the result of a joint effort between Alaska Department of Natural Resources (ADNR), Bristol Bay Coastal Resource Service Area staff, and the Department of Fish and Game. The plan identifies goals and management intent and public use sites for 25 management units in the planning area. Additionally, management policies for long-term uses are identified, as are guidelines for specific management direction for the 25 management units, which constitute the planning area.

Limits on use levels and number of camps were not addressed in the plan. However, much of the policy contained in the plan directly affects commercial operators who provide sport fishing services within the area. Therefore, this plan affects sport fishing opportunity in an indirect but measurable way.

This plan is not scheduled for review or revision at this time. Implementation continues through the ADNR process. Compliance with the permit stipulations required by the plan is considered good to excellent for the sport fishing industry.

### **Wood-Tikchik State Park Management Plan**

The Wood-Tikchik State Park Management Plan was adopted by the ADNR in 1986, approximately 8 years after the largest state park in the nation was created. The park is managed by ADNR's Division of Parks and Outdoor Recreation. The legislation forming the park also created a park management council made up of seven representatives from the village councils of Koliganek, New Stuyahok, Aleknagik, the Dillingham City Council, Bristol Bay Native Association, ADNR, and ADF&G. The two state agency representatives are expected to provide a broad statewide perspective to the council and its recommendations. A major responsibility of the management council was to develop and review the park management plan and thereby establish policy for the park.

In brief, the goals of the 1986 plan were to: (1) protect the fish, wildlife and habitat resources; (2) protect and manage park resources to ensure continued traditional subsistence activities and Native allotment rights; (3) provide for the outdoor recreation needs of visitors appropriate to the park values and setting; (4) protect and manage areas of significant scientific, educational, visual quality, cultural, or historic value; and (5) establish management practices which respond to regional and statewide recreational and tourism demands.

By 1998, many of the issues initially addressed by the plan had changed, and growth in use of the park has been apparent. In particular, many of the Native allotments within the park had been conveyed to private ownership or were scheduled to be resolved very soon. The privatization of approximately 8,000 acres within the park, growth of nearby communities, and increased public use of the park lead ADNR and the park council to embark upon a review and revision of the plan in the fall of 1998. Work on the plan revision has been limited to organization of a subcommittee, including some members of the general public, and identifying issues. Some issues identified include use levels and boating safety and congestion on the popular angling waters of the Agulowak and Agulukpak rivers. Work is expected to continue through 1999. ADF&G has and will continue to participate in the plan review and revision.

### **Nushagak Mulchatna Watershed Council**

In 1998, the Bristol Bay Native Association (BBNA) obtained a federal Environmental Protection Agency (EPA) wetlands grant. During May, BBNA invited local governments, Alaska Native Claims Settlement Act (ANCSA) Corporations, Bristol Bay Coastal Service Area, related state (ADF&G, ADNR, Alaska Department of Environmental Conservation [ADEC]) and federal agencies to participate in a discussion regarding water, environmental issues, and human impacts in the Nushagak Mulchatna drainage. BBNA has enlisted The Nature Conservancy (TNC) to provide technical assistance with the project. A steering committee was formed and met in August to develop an organizational structure and provide an initial focus to the watershed project. From the August meeting the Nushagak Mulchatna Watershed Council (NMWC) was formed and the following mission statement was written: To serve as a forum for the implementation of solutions to common natural resource and environmental problems and opportunities in the Nushagak Mulchatna Watershed. In addition to gathering and exchanging natural resource and environmental information and promoting cooperation among landowners, regulatory agencies and resources users, an important function of the Council will be to develop a watershed agreement(s) once the planning process progresses further.

To date, the Division of Sport Fish has participated minimally in the fall meetings. A time may come when more participation will be needed from several department divisions to explain policies and regulations or to contribute data and analysis. Participation in this forum may be a good opportunity for department outreach and coordination with a wide variety of local agencies and the public.

### **MAJOR ISSUES**

Issues affecting management of the sport fisheries in Southwest Alaska can be both biological and social in nature. With the growth of any resource-based activity comes concern for resource conservation and problems related to the competition for those resources between user groups. Significant conservation concerns exist for the following fisheries:

#### **Alagnak River Rainbow Trout**

The Alagnak River is located in the eastern portion of the management area and flows into the Kvichak River approximately 20 miles north of King Salmon. Effort in this fishery increased substantially in 1992 (Table 3, Figure 5). Since 1993, sport effort has averaged 12,362 angler-days per year, accounting for 9.5% of the total effort within the SWMA (Figure 5). The Alagnak River is the second most popular fishing destination in southwest Alaska, after the Naknek River.

In the lower portion of the drainage anglers pursue chinook, coho, and sockeye salmon. In the middle and upper reaches, rainbow trout are a very popular species. From 1993 to 1997 the average catch (includes fish released and kept) has averaged over 22,000 rainbow trout per year (Figure 5). At this level, the Alagnak River is the most popular rainbow trout fishery in Southwest Alaska. Prior to the 1998 season, average harvest of rainbow trout was estimated to be 148 fish per year (Figure 5), and was likely selective for large fish.

About 1993, coincident with increased fishing effort, department staff began receiving complaints that the rainbow trout stocks in the Alagnak were declining. Data for the Alagnak River rainbow trout fishery prior to 1996 is sparse; however, results from a sampling trip in 1989 suggested that the size composition and age structure were depressed. In 1996 a joint ADF&G

**Table 3.-Alagnak River sport fishing effort and rainbow trout harvest and catch, 1981-1997.**

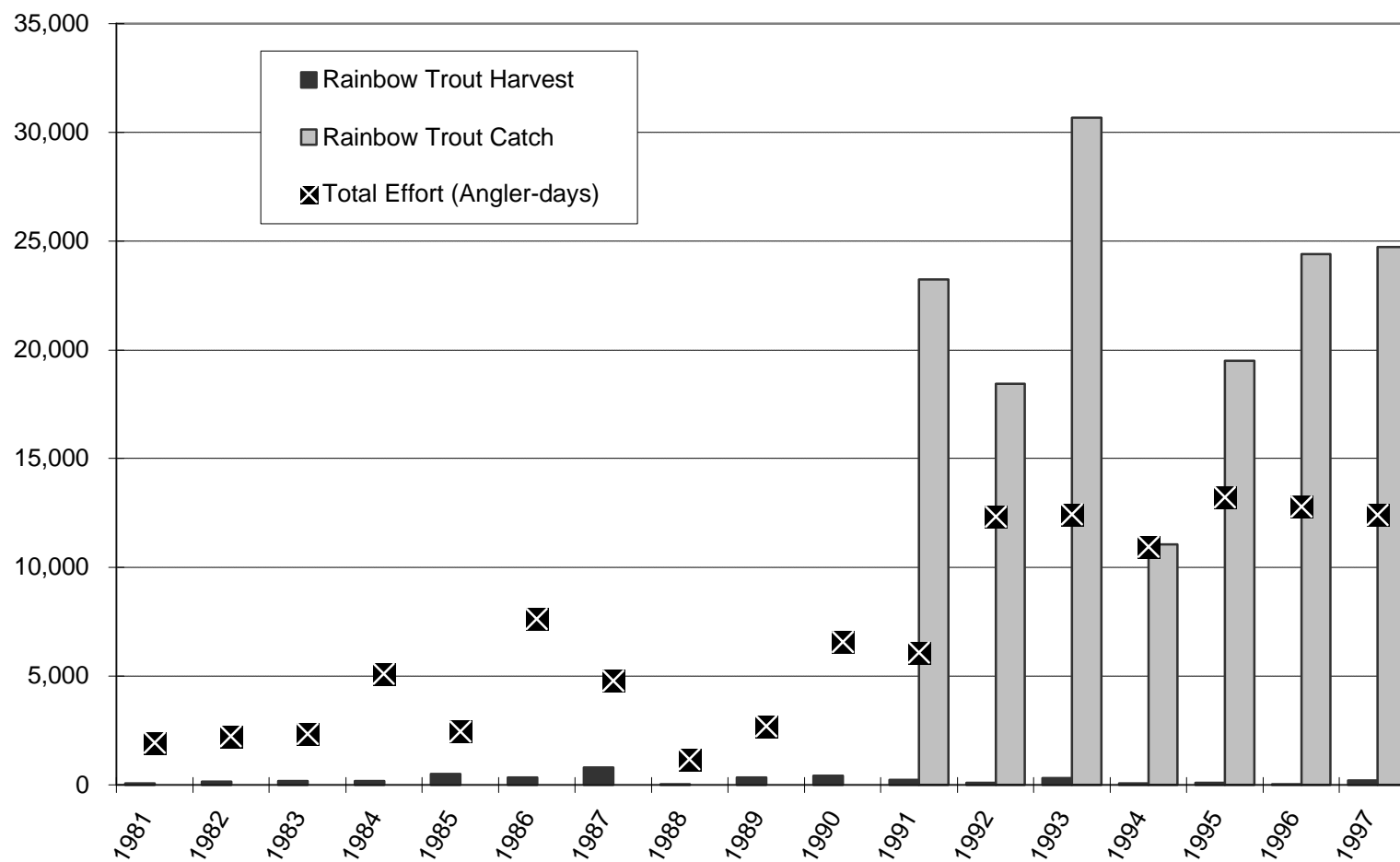
Year	Total Effort (Angler-days)	Rainbow Trout Harvest	Rainbow Trout Catch
1981	1,947	76	
1982	2,252	157	
1983	2,348	178	
1984	5,119	187	
1985	2,473	518	
1986	7,628	340	
1987	4,786	824	
1988	1,182	18	
1989	2,717	343	
1990	6,571	423	
1991	6,079	243	23,244
1992	12,323	111	18,452
1993	12,440	312	30,665
1994	10,949	74	11,062
1995	13,232	107	19,499
1996	12,784	24	24,395
1997	12,405	221	24,716

Source: Mills 1979-1994, Howe et al. 1995-1998.

and National Park Service (NPS) creel survey was conducted at the outlet of Nonvianuk Lake in the upper Alagnak River drainage (Jaenicke 1998a). Thirty-four anglers were asked to compare their experience in 1996 to experiences in the past with regard to catch rate and average size of the catchable population (Table 4). Many anglers felt both catch rate and size composition had diminished (Jaenicke *Unpublished*). In addition to the survey, NPS staff also collected size and age samples from the catchable population. Results showed the size distribution to be skewed to small fish, and age composition to be primarily age-4 and -5 fish (Jaenicke 1998a).

As a result of the 1996 work, an emergency order closing the Alagnak and Nonvianuk rivers to the sport harvest of rainbow trout was issued effective July 1, 1996, and was reissued prior to the June 8 opening in 1997.

Additional sampling was conducted in 1997 (Jaenicke 1998b, and *Unpublished*). The size composition information collected throughout the drainage did not suggest the depressed condition indicated in 1996. The study found the following points:



**Figure 5.-Alagnak River sport fishing effort and rainbow trout catch and harvest, 1981-1997.**



**Table 4.-Results from an angler opinion survey concerning the current status of rainbow trout fisheries in the Alagnak River drainage, 1996 and 1997.**

Question 1: Have you ever fished here before?

Response	1996 Nonvianuk R. headwaters		1997 Alagnak R. headwaters	
	Number	Percent	Number	Percent
Yes	34	21.9	17	11.9
No	120	77.4	126	88.1
Response not recorded	1	0.6	0	0.0
Total	155	100.0	143	100.0

Question 2: If you have fished here before, how does the current abundance of rainbow trout compare with your previous trip (less abundant than previous trip, same, or more abundant than previous trip).

Response	1996 Nonvianuk R. headwaters		1997 Alagnak R. headwaters	
	Number	Percent	Number	Percent
Less abundant	6	17.6	4	23.5
Same	28	82.4	8	47.1
More abundant	0	0.0	5	29.4
Total	34	100.0	17	100.0

Question 3: If you have fished here before, how does the current average size of rainbow trout compare with your previous trip (smaller average size than previous trip, same, or larger average size than previous trip)?

Response	1996 Nonvianuk R. headwaters		1997 Alagnak R. headwaters	
	Number	Percent	Number	Percent
Smaller average size	12	35.3	5	29.4
Same	22	64.7	9	52.9
Larger average size	0	0.0	3	17.6
Total	34	100.0	17	100.0

1. Harvests of rainbow trout are estimated to be small, but are likely selective for large fish.
2. Many anglers feel the catch rate and size composition have diminished over time.

A number of proposals were brought to the 1997 Board of Fisheries meeting to restrict harvest opportunity in the Alagnak River. The department favored more conservative regulations for resident species and recommended two options for addressing the potentially depressed stock condition for Alagnak rainbow trout: (1) restrict sport harvest by establishing a maximum size limit, or (2) establish a catch-and-release fishery during the open water season. Either action was expected to accomplish the goal of improving the size and age compositions of this fishery.

During their November 1997 meeting the Board of Fisheries adopted regulations restricting the sport fishery to catch-and-release only during the open water season in an effort to avoid potential damage to this population (ADF&G 1998b).

### **Naknek River Rainbow Trout**

Since the early 1970s rainbow trout in the Naknek River have undergone a decline and subsequent recovery in the abundance of larger, older fish in the catchable population. Research in the late 1980s confirmed comments from the angling public that the average size of the catchable population and the number of spawning-sized fish had declined (Minard 1990). Regulation changes intended to protect larger, older fish through bag and size limit manipulations were recommended by the department and adopted by the Board of Fisheries in 1990. Studies conducted in 1993 and 1995 indicate the rainbow trout population has responded favorably to those actions.

Currently the angling public expresses mixed opinions on how to transition from a period of recovery to a management strategy that would maintain an apparently recovered rainbow trout stock. A variety of regulation proposals addressing the future of this fishery were submitted for the November 1997 Board of Fisheries meeting. The Board deferred any immediate action and formed a subcommittee to develop a rainbow trout management plan for the river.

During April of 1998, Board members Larry Engel and Ed Dersham visited the river to observe this most controversial segment of the fishery, and to hear local public testimony. The Division of Sport Fish committed to review all available data from the Naknek River rainbow trout fishery, and to collect additional information from the early spring fishery. In addition, the division prepared a framework for the Naknek/Kvichak Advisory Committee as a starting point to build a management plan. There has been no activity by the Board subcommittee since spring of 1998. By December 1998, a number of Advisory Committee members had departed, and no progress had been made on the plan.

### **Nushagak Coho Salmon**

Originally projected to be poor, the 1998 return was good and escapement goals were met. However, in six of the previous seven seasons, Nushagak River coho salmon returns were considered poor. Although sport harvests are considered negligible in most years, the Nushagak River drainage was closed for much of the normal sport season in 1997 to protect a very weak return. Management of Nushagak coho salmon is guided by the Nushagak River coho salmon management plan, in which recommended actions are linked to sonar estimates of inriver

abundance (5 AAC 06.368). While the direction is clear, the erratic returns of recent years and problems of accurately assessing run size and timing have made it difficult for the staff to implement the plan. During the last 10 years, run sizes have been so erratic that sport fishing opportunities have been very unpredictable.

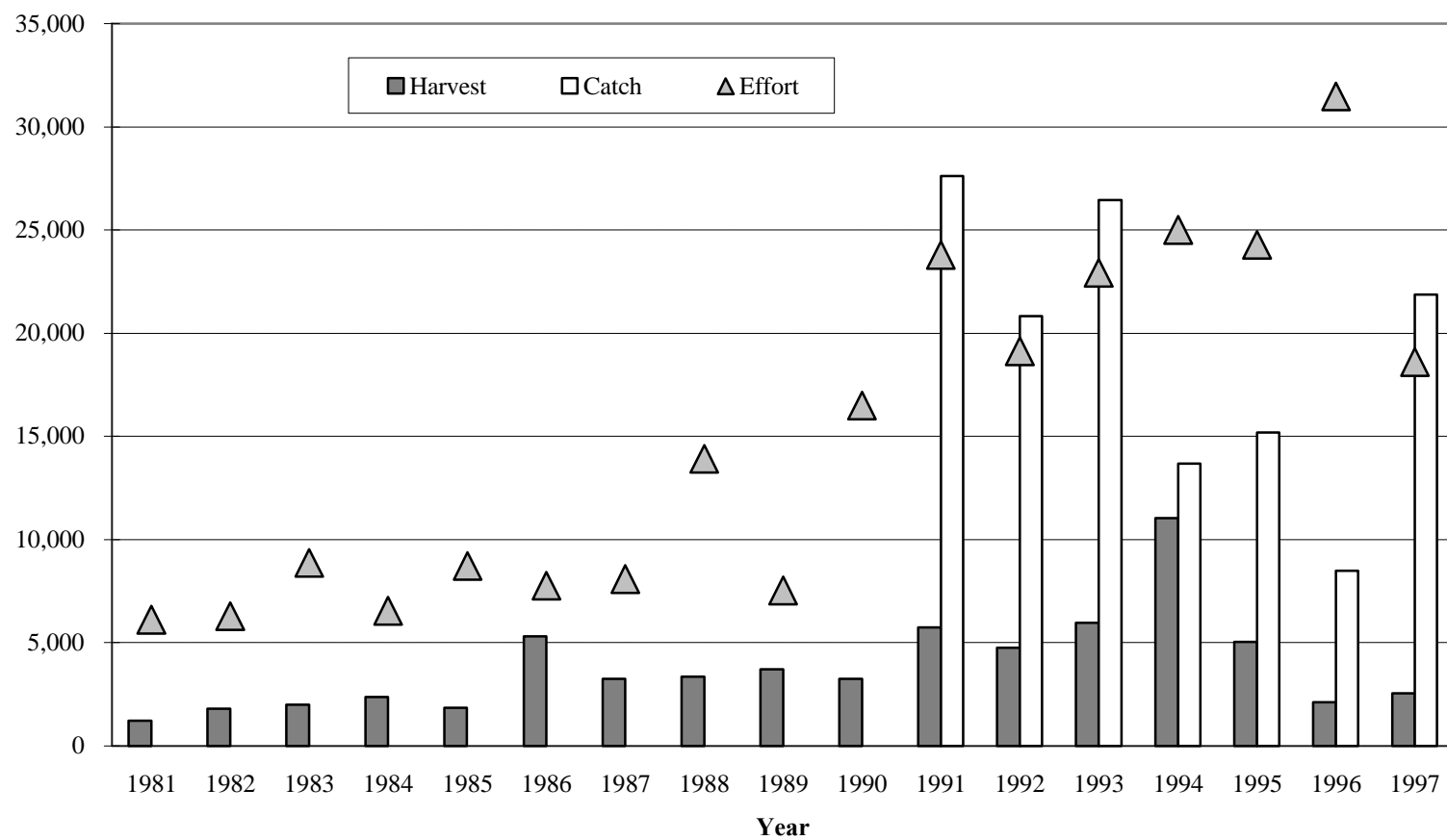
### **Iliamna River Dolly Varden**

Dolly Varden stocks in the Iliamna River appear to have suffered a significant decline in abundance and a loss of the larger, older age classes. Records from area lodges that have a history fishing the Iliamna River show a significant decline in both the number of Dolly Varden landed and the size of those fish. Visual counts of Dolly Varden in the lower Iliamna River in 1996 and 1997 indicate a population in the low thousands to mid hundreds (Jaenicke 1999). Emergency order restrictions were issued in 1996 and 1997 dropping bag and possession limits from 10 per day to catch-and-release. Compliance appeared excellent. The Alaska Board of Fisheries adopted a more permanent catch-and-release restriction for this fishery during their November 1997 meeting. Local concerns about guide use and jet boat traffic in this river are ongoing.

### **Nushagak Chinook Salmon**

Four issues have been a concern to management of the Nushagak chinook salmon fisheries:

1. The accuracy and precision of sonar estimated inriver abundance. In 1997 sonar-estimated inriver abundance differed significantly from escapement estimated by aerial survey. Sonar estimates totaled 40,300 fish, while aerial estimates were between 80,000 and 85,000 fish. The apparent underestimate by the sonar may have been caused by the record low water conditions causing chinook salmon to migrate further from shore than normal. Chinook salmon were observed migrating offshore. Management actions tied to the sonar counts resulted in significant restrictions in the sport fishery (catch-and-release on June 30, 1997) that, in the end, were unnecessary. To address this issue in 1998, the Commercial Fisheries Division conducted an extensive test-netting program across the full width of the river at the sonar site. In early July, the Sport Fish Division conducted some exploratory work around the sonar site in preparation for a radiotelemetry study planned for the summer of 1999. By September, results of the test net project showed clearly that a significant number of chinook salmon are not counted by the sonar counter. Forecasted budget shortfalls forced cancellation of the radiotelemetry project for 1999. Continued aerial surveys to assess escapement on the spawning grounds may be important to address this problem.
2. The ability to keep the sport fishery within the 5,000 fish allocation. Sport harvest exceeded 5,000 fish during several years in the early 1990s (Figure 6). During the 1997 fall meeting, the Board of Fisheries adopted a set of regulations designed to keep the sport harvest within the 5,000 fish allocation. For the 1998 season, all anglers were restricted to a daily harvest of two chinook salmon, only one could exceed 28 inches. In addition, all anglers were limited to a total annual harvest of four chinook salmon from the drainage. Guides were further restricted from retaining any chinook salmon while guiding. The Nushagak River upstream from the confluence of Harris Creek, and the tributary of the Kokwok River were closed to chinook salmon fishing year-round. The Nushagak River downstream from the outlet of the Iowithla River closes to chinook salmon fishing after July 31. This combination of



**Figure 6.-Sport harvest and catch of chinook salmon and total angler effort from the Nushagak River, 1981-1997.**

regulations was expected to reduce the harvest potential of the sport fishery by about 50% and keep the harvest within the current allocation. Evaluation of the new regulations awaits the results of the statewide harvest and catch survey of the 1998 fishery (Howe et al. 1999).

3. The precision of commercial fish management and the effect on sport fishing opportunity. Under the 1996 management plan the commercial fishery was to be managed for an inriver return of 75,000 chinook salmon. Fish surplus to the 75,000 were to be taken in the commercial fishery. Decisions to open and close the commercial fishery in an effort to harvest chinook salmon surplus to the 75,000 were based on the preseason forecast, commercial fishery performance, subsistence catch levels, and sonar-estimated inriver abundance. As with all management tools, a level of error is associated with each of the indicators of run strength. In addition, there is no precise formula for determining the length and frequency of commercial periods.

The sonar estimate of chinook salmon passage has ranged from 39% over the inriver goal to 30% under the goal since 1990. From 1990 through 1994, management of the commercial fishery was conservative in an effort to rebuild the stock. During the most recent years, management of the commercial fishery has been more aggressive in an effort to comply with the plan by harvesting all fish surplus to the 75,000 inriver goal. Since 1995 the inriver return ranged from 28% above the goal to 46% below. Management precision within the commercial fishery (measured by the difference between the inriver goal and the actual return) has been roughly plus or minus 30% or about 22,500 fish. In some cases this equated to one commercial fishing period.

A comparison of recent escapement levels to resulting returns found that the 30% annual variation has little biological consequence to future production. However, the consequence of this wide variation has been highly significant to the user groups. Where the inriver goal may have been undershot by as little as 13%, the management plan required that the sport fishery be restricted inseason (as in 1996 and 1997). Such restrictions were highly disruptive to anglers and the supporting industry.

From the analysis above, and public testimony, the Board of Fisheries addressed the problems by “desensitizing” the management plan, reducing the 65,000 fish action trigger in the plan to 55,000 fish.

4. The quality of escapement. Chinook salmon vary significantly in both age and size, much more so than other salmon species. The spawning potential for a chinook salmon run depends to a large extent on the sex, age, and size structure of the fish on the spawning grounds (i.e., the spawning escapement). While it is not specifically stated, the 65,000 fish biological escapement goal (BEG) for Nushagak chinook salmon carries with it the assumption of adequate levels of egg-bearing females in the escapement to maintain productivity.

Inriver users expressed significant concern regarding the unusually high proportion of jacks (small males) and a scarcity of females they observed in the 1995 and 1996 returns. The department examined size and age composition of chinook salmon captured at the sonar site and in the subsistence fishery below the sonar site. Two areas of concern were found with respect to escapement quality: (1) The proportion of female spawners was less than desired for adequate egg deposition, and (2) a pattern has developed where age composition of early

season escapement differs substantially from age composition later in the run. These problems appear linked to department management of the commercial fishery, and if left unresolved, could result in decreased future yields of Nushagak River chinook salmon.

To avoid low proportions of females in the 1997 escapement, the department only allowed commercial fishing after a pulse of chinook salmon had entered the river. The intent was to allow untouched portions of the run with “natural” size and age compositions to pass through the commercial district and, ultimately, onto the spawning grounds. This strategy appears to have worked in that a greater number of productive females appear to have escaped in 1997 than in the previous 2 years.

The Board of Fisheries amended the plan so the commercial fishery will be managed much as it was during the 1997 season. New amendments to the plan directed the department to “...maintain a natural representation of age classes in the [inriver] escapement...”. There was no amendment to address the mid-season shift of age and size composition in the escapement.

The new commercial and sport fishery management regime coupled with a strong run appeared to be quite successful for 1998 season.

## **OTHER ISSUES**

Significant social issues concerning sport fisheries in the SWMA include:

1. Preservation of quality sport fishing opportunities in the face of greater competition between user groups for limited resources. Sport fishing effort is increasing throughout the management area at approximately 7% to 11% per year (Figure 2). Maintenance of high quality sport fishing opportunity within the area is becoming an increasing challenge that is generally being addressed thorough management plans and coordination with federal and other state agencies. Management objectives that stipulate desired catch rates, population attributes, and address diversity of opportunities are being continually developed and presented in the public process. During the upcoming fiscal year, for example, management objectives for selected rainbow trout fisheries will be reviewed and published. Additionally, an areawide management plan for Arctic grayling is to be drafted. There remains the issue of limited access fisheries to preserve quality. As of yet, there are no such fisheries within the area, however, demand for such fisheries is growing and the Board of Fisheries initiated the first tentative steps to address this topic for the Naknek River spring rainbow trout fishery during the November 1997 meeting.
2. Increasingly complex land ownership patterns. Of particular concern has been securing access to public lands and waters through negotiated easements across private lands. Limited Department of Natural Resources staff time available for working on these issues necessitates Sport Fish staff remain deeply involved if a desirable outcome is to be achieved. Approximately 20% of the area management biologist's time is spent on land and access issues.
3. Coordination with federal, other state agencies. Ever-increasing staff time is devoted to coordination with other agencies with a management interest in the area fisheries. Efforts have been made to improve communication between agencies and to work cooperatively on projects. To facilitate communication, annual Southwest Interagency Meetings (SWIM) have

been conducted in King Salmon or Dillingham each February and hosted by various agencies on a rotating basis since 1994. Usually an informal 2-day event, SWIM has resulted in improved data exchanges, coordination of some small field projects, some informal agreements on research approaches, and appears likely to lead to more and larger jointly funded and staffed programs in the future. Still, the vast area, diverse fisheries, and divergent missions can make ongoing close communication difficult. In the future, local governments and tribal organizations may become involved in these SWIM conferences.

4. Potential effects of federal management of subsistence fisheries on sport fishing opportunity. In the near future the federal government may take over management of all subsistence fisheries within the state. Under federal management, priority will be given to rural subsistence uses. Uses, such as sport fisheries, that compete for resources and space may be restricted in times of shortage. There is a very real possibility that sport fishing opportunity in a number of popular waters may be restricted under such management. Department staff are working to closely follow the developments; however there is little area-level staff can do to affect this issue.

## **ONGOING RESEARCH AND MANAGEMENT ACTIVITIES**

There were four main programs conducted in 1998; three major research projects and the routine management activities.

### **1. Bristol Bay Rainbow Trout Studies.**

This project provided funding for the following three projects:

- a. Pathology sampling. In 1998, the SWMA staff coordinated with the U. S. Fish and Wildlife Service, Fisheries Research Office (FRO) in King Salmon and Togiak Refuge staff to collect rainbow trout tissue samples from widely dispersed geographic sites within southwest Alaska and Kodiak. Funded to investigate the potential presence of whirling disease, the tissues were tested for a wide range of common fish pathogens to maximize the return for the cost of collection and to provide a general pathogen baseline for the area. Initial pathogen testing was conducted by the ADF&G pathology lab in Anchorage. Whirling disease testing will be conducted in labs in Washington State. ADF&G staff from Dillingham assisted with samples from the upper Nushagak River and the Agulowak River. This coordination arose directly from the 1998 SWIM meeting. Results will be reported by USF&WS FRO in King Salmon.
- b. Volunteer creel survey program at Lower Talarik Creek. Objectives include the census of sport fishing effort and catch, estimation of size and age compositions of catchable trout and angler demographics. Results show a generally stable level of effort as well as desirable catch rates and size compositions. Results of the Lower Talarik Creek surveys are reported in the Fishery Management Report series. Work at this site is conducted in part to meet the obligations of a cooperative agreement between ADF&G, ADNR, and the Nature Conservancy.
- c. Biological sampling of the catchable population of rainbow trout in the upper Nushagak River. Project objectives included the estimation of size and age composition of rainbow trout available for capture in the sport fishery in the

Nushagak River upstream from the confluence of Harris Creek. Data concerning frequency of hook scars and conditions were also collected. Results are presented in a following section of this report.

- d. Studies on the overwintering rainbow trout stocks on the upper Kvichak River. Since 1987, eleven seasons of field work have been conducted at this site. No work was conducted in 1998. Objectives of the project were to estimate survival, abundance and recruitment as well as size and age composition. The number of fish appears to be stable and estimates of recruitment and survival appear sound. In 1998 staff committed to compile and analyze the data and produce a final, professional-level report within the next 2 years.

## 2. Southwest Alaska Salmon Studies.

This project provided funding for monitoring the chinook salmon sport fishery on the lower Alagnak and Togiak rivers, and the coho salmon fishery on the lower Kanektok River. Fishery effort, timing and location, angler demographics, and effectiveness of current management strategies will be reported in Fishery Data Series reports for publication in 2000 (Naughton and Gryska *In prep a*, *In prep b*; Gryska and Naughton *In prep*).

## 3. Resident Species Studies.

This project provided funding for the first year of the Lake Aleknagik northern pike project. This is a department-funded graduate student project designed to provide basic information about this important sport and subsistence species. Project objectives include assessing whether the lake population is a single stock, identifying important spawning, feeding and overwintering locations, estimating size and age composition of pike  $\geq 300$  mm, and assessing the abundance and survival of northern pike in Lake Aleknagik. These data may be used to develop management, population monitoring, and regulatory recommendations for this stock. After a second year of data collection in 1999, project results will be presented in the graduate student's master's thesis to be completed by May of 2000. This project employed two local Bristol Bay Economic Development Corporation interns through the whole summer of 1998.

## 4. Management Activities.

Management activities in 1998 included participating with local advisory committees in the Board of Fisheries process, public contacts, disseminating information, fisheries monitoring, coordinating with staff from other divisions and resource management agencies, and habitat monitoring and permit review. Coordinating with ADNR, The Nature Conservancy, and local governments to establish a Special Use Area at Lower Talarik Creek consumed significant staff time from July through December.

## **ACCESS PROGRAM**

Management of the sport fisheries in Southwest Alaska includes the development of projects that promote access for the angling public to common property resources. About 15% of the annual Sport Fish Division budget is dedicated to the acquisition, development and maintenance of public boating facilities and additional nonboating projects are funded at the discretion of the division. Access projects that benefit sport fishermen may be as simple as a dumpster for collection of refuse or as complex as the development of a boat launch with parking and picnic facilities.



The Division has a fairly well-defined process for the selection and prioritization of projects that are being considered for funding (ADF&G *Unpublished*). There are essentially seven steps in the process: (1) proposed by Area Management Biologist, (2) Regional Access Coordinator Review, (3) Statewide Access Coordinator Review, (4) Acquisition, (5) Development, (6) Maintenance and (7) Management. All proposed projects must go through the same review process and be assigned a priority based on their individual merit. The following is a list of projects presently being considered in Southwest Alaska.

### **Aleknagik Lake**

This project is located in the central portion of the management area on the south shore of Lake Aleknagik. This site is the most common launching point for traffic heading into or returning from the Wood/Tikchik State Park. Popular sport fishing waters accessed from this point include the Wood, Agulowak and Agulukpak rivers, and the many bays and tributary streams to the Wood River lake system. The project entails the acquisition of property sufficient for the construction of a boat launch, parking for up to 60 vehicles with trailers, an outhouse facility, and garbage service. Total project cost is estimated to be \$1.3-\$1.7 million of which about \$300,000 to \$400,000 will come from ADF&G's access program budget.

As of December 1998, steps 1 through 4 were complete, design was nearly final, and bid requests for development were scheduled to be announced in late spring of 1999. Development of the site is scheduled for summer of 1999.

### **Lake Camp**

The outlet of Naknek Lake, commonly referred to as Lake Camp, is frequently used by sport fishermen as an access point for the upper Naknek River and Naknek Lake. The upper reach of the Naknek River supports the second largest rainbow trout fishery in Bristol Bay. Over 20,000 angler-days are expended by recreational fishermen on the Naknek River each year. Presently, access to the upper river is limited to two nearby, undeveloped launch sites on private land and on National Park Service lands. Technically, any use of the private site constitutes trespass. With development of the Lake Aleknagik site assured, an upper Naknek public boating and access site is the highest large project priority for the access program in the SWMA.

This project will entail the acquisition and development of a site for a public launch. Facilities should include a launch ramp, outhouse, picnic area and refuse containers. To date, the Access Project Data Sheet (step 1) has been filled out (February 1992) and the project is now on hold pending review by the regional access coordinator (step 2). Complicated land ownership and unwilling sellers confound resolution of this project.

During the fall of 1998, the regional access coordinator was making a final overture to private land holders and beginning to explore the potential of developing a site on nearby Katmai National Park lands. Initial contacts with the Park Service have been encouraging and their lands seem to hold the most promise if a site is to be developed within the next several years. A follow-up meeting between Division of Sport Fish Access personnel and NPS staff is planned for the spring of 1999 to continue project development. However, this land once belonged to the US Airforce and pollution may influence whether or how this land can be developed. The US Airforce and Park Service will be assessing the location, type, and extent of the pollution during late 1998 and into 1999.

## **Newhalen River**

This project is located at a trailhead near the transient parking ramp at the Iliamna airport, which leads to the Newhalen River falls. Sport fishermen utilize this location heavily in late June and July while fishing sockeye salmon, and to a lesser extent during the months of August and September while fishing rainbow trout. The installation of an outhouse and refuse containers, as well as a garbage collection and maintenance contract, were completed in the spring of 1993. Additional outhouses were installed at the trail terminus in the spring of 1995. Overall reaction on the part of local residents and the angling public has been highly favorable. The next phase includes the development of a boardwalk (hardened trail) across sensitive habitat to avoid additional erosion and improve the ease of access.

## **Kvichak River at Igiugig**

This project will develop a walkway from the community road system along the banks of the Kvichak River, directing foot traffic away from the village itself. While anglers visit the Kvichak River throughout the open water season, this project has been conceived to accommodate the numerous shorebased anglers during the late June to mid July sockeye salmon fishery. Steps 1 through 4 and 6 have been completed and step 5 can begin at any time. Currently, the project has been awaiting development of a gravel source. The project has strong support of the local community. It is expected to address trespass issues, enhance angling opportunities, encourage orderly conduct and development of the fishery, and to minimize stream-bank damage from foot traffic.

## **Agulukpak River Camp Sites**

The Agulukpak River, within the Wood Tikchik State Park, is designated as a special management water under the Southwest Alaska Rainbow Trout Management Plan. It is a popular destination for fly fishermen seeking abundant rainbow trout. At the head of this short river, the Alaska Department of Natural Resources, Division of Parks has created several hardened sites to accommodate overnight camping parties. The river is a major spawning area for sockeye salmon and attracts numerous brown bears during the fall, the same period when trout angling is at its peak. In 1997 two food storage caches were provided by the ADF&G Access program and erected by the Division of Parks as a measure to reduce potential human-bear conflicts at the camp site.

## **OUTREACH PROGRAM**

An important aspect of successful resource management includes public outreach. Over the years a number of methods including presentations, special publications, and signs, have been used to inform the public about Southwest Alaska fishery resources and management activities.

### **Presentations**

The Southwest Alaska staff has conducted various presentations including fishing and fly tying seminars, classroom and school visits, guide information meetings, and talks and slide shows to assorted groups (Table 5). Given the shortage of staff during much of the 1998 year, presentations limited to guide meetings were conducted in Portage Creek and King Salmon during early June of 1998. For the first time a guide meeting was conducted in Ekwok in an effort to reach a number of local guides as well as some newer guide camps that are expanding into this portion of the Nushagak River.

Including two staff members participating as science fair judges, the Dillingham schools were visited seven times during 1998. On two occasions local staff members made presentations to some elementary students. Three other visits were the work of Fritz Kraus, with the department's information and education staff from Anchorage. His visits included Dillingham and Koliganek schools. All visits were well received.

**Table 5.-Summary of outreach activities in 1998.**

Presentations	Fishing classes/ seminars	0
	School visits <sup>a</sup>	5
	Guide meetings	3
	Talks and slide shows	0
Publications	Magazine articles	
	News releases	
	Current brochures available	9
	Information packet mailings	233
Signs	New in 1998	1
	Updated in 1998	4
Other	Science fair judges	2
	Assistance with school projects	0
	Invitations for media participation	2

<sup>a</sup> Includes visits to area schools by Fritz Kraus of the Anchorage office: Dillingham Elementary 75 students; Dillingham High 90 students; Koliganek School 85 students.

## Publications

Written materials have been, and continue to be, developed for the public. In addition to the occasional magazine article and routine news releases announcing special regulations or management actions, the following brochures are available (Table 5): commercial services list, float trip guide, Southwest Alaska angling guide, Dillingham day trip guide, Naknek River regulation brochure, Newhalen River access and regulation brochure, Togiak Refuge Waters fishing regulation brochure, Southwest Alaska Rainbow Trout Plan, and an airport tear sheet jointly produced with ADNR, USF&WS, and Bristol Bay Coastal Resource Service Area, on

department activities in Southwest Alaska. The Dillingham office also distributes department-produced brochures on catch-and-release fishing, fish handling, fish life histories, and bear safety as well as brochures from other agencies such as the Togiak National Wildlife Refuge and Forest

Service. Each spring a Southwest Alaska sport fisheries outlook is written to address many of the most popular fisheries for the coming season.

This written material is mailed out to anyone requesting it. Through December 1998, the Dillingham office mailed 233 information packets to people around the world. Since we began keeping records in 1993, annual Dillingham mailings have ranged from 136 to 233, and average 173 per year.

A major part of the 1998 outreach effort was to revise several pamphlets to incorporate the fishing regulations changes adopted by the Board of Fisheries during their meetings of the previous winter. A major revision of the Southwest Alaska Angling Guide was initiated but only reached the draft stage before the demands of the fishing season halted the project.

From late May through early September, a weekly fishing forecast is written and released to news media outlets and recorded on the department's recorded information system in Anchorage. Regularly updating the forecast and making it available on the department web site helped to keep individual phone calls to a manageable level during the entire fishing season.

## **Other Information Outlets**

### **Signs**

The Southwest Area office continues to explore and develop additional means to get information to the angling public. Over the last several years, signs have been installed in strategic locations such as airport terminals, boat launches, and trailheads. Topics of the signs may include fishing regulations, easement and directions, angling techniques, and bear safety. Signs are currently installed in Iliamna, Igiugig, King Salmon, and Aleknagik. In 1998 and as with the informational pamphlets, most regulatory signs had to be revised and installed. Revised signs were designed and installed at three sites in the Naknek River area, one in Igiugig, and two in the Iliamna/Newhalen area. A completely new regulatory sign was designed and installed at the Quinhagak airport to inform anglers of the many new regulations adopted on the nearby Kanektok River.

### **Regulation Hotline**

It is difficult to inform the public about inseason regulation changes (emergency orders) for Southwest Alaskan fisheries, but these changes are becoming increasingly common. In early 1997 the department installed a Southwest Alaska sport fishing regulation "Hot Line" recording at 907-842-REGS (907-842-7347). The recording is updated whenever emergency orders are issued for Southwest Alaska sport fisheries and is available to callers 24 hours a day.

### **King Salmon Hotline**

The community of King Salmon, Alaska is a major transportation hub for Southwest Alaska. Many of the anglers passing through the town visit the local department office. However, much of the year, no Sport Fish Division personnel are available to staff this office. A free telephone connected directly to the Dillingham Sport Fish office available since May 1997 improves service for anglers and relieves public demands on staff from other Divisions.

## **Local Hire and Workforce Development**

The Dillingham office has a long history of seeking out and hiring qualified local residents for seasonal work. Area schools have allowed high school students to assist with field projects as a means of providing exposure to the department's work. For several years, students from

Dillingham, Iliamna, Naknek/King Salmon, or Igiugig participated in the spring rainbow trout project at Igiugig. Students have also participated in char studies at Lake Aleknagik, and as volunteers on Nushagak River creel surveys for a 1 or 2 week stint. Those students who showed special interest or aptitude were frequently hired for summer work with the department.

The area outreach program expanded in a new direction during 1998. The Bristol Bay Economic Development Corporation (BBEDC) was formed to coordinate the area's Community Development Quotas allocated from the Bering Sea groundfish harvests. An aspect of BBEDC's program is to train local residents to enhance employment opportunities. For the same reasons, BBEDC has developed student internships with local governments, particularly resource management agencies.

In 1998, BBEDC approached the area sport fish biologist about placing student interns in sport fish projects. ADF&G agreed to provide work for two interns in existing field programs, provided a list of minimum qualifications, and retained final approval authority after a probationary work period. BBEDC was to locate and hire the interns. The interns then worked as volunteers for ADF&G. After a slow start, two students were selected and assigned to the Lake Aleknagik pike project (see Area Staff section). Initially scheduled to work for about 2 weeks each, both students worked out well and stayed with the project until mid August. Given a number of unexpected delays and difficulties in the project, the BBEDC interns proved essential to the success of the pike program. The Dillingham office intends to continue this arrangement with BBEDC for future field seasons.

#### **AREA STAFF**

The following is a list of the staff and project volunteers who conducted sport fishery work in the Southwest Alaska Management Area during 1998. In some case these positions were funded by other region projects or other agencies, but conducted work in the area.

<b>Paid Staff</b>		
Mac Minard	Area Biologist (Fishery Biologist III)	January 1 to May 31
Dan Dunaway	Asst. Area Biologist (Fishery Biologist II)	January 1 to June 30
	Area Biologist (Fishery Biologist III)	July 1 to December 31
Vacant	Asst. Area Biologist (Fishery Biologist II)	July 1 to December 31
Michael Jaenicke	Fishery Biologist I	January 21 to December 8
Helen Jones	Administrative Clerk III	January 1 to December 31
Jason Dye	Fish & Wildlife Technician II	May 1 to August 28
Wesley Jones	Fish & Wildlife Technician II	April 27 to August 28

<b>Paid Staff (continued)</b>		
Craig Schwanke	Fish & Wildlife Technician II	May 4 to December 4
Corey Schwanke	Fish & Wildlife Technician II	August 1 to November 25
Paul E. Lester	Fish & Wildlife Technician I	July 1 to July 31

<b>Volunteers</b>		
Cody Aloysius	Volunteer/BBEDC Intern, Pike	June 15 to August 15
Karen Pletnikoff	Volunteer/BBEDC Intern, Pike	June 1 to August 27
Mathew Mills	Volunteer/Lower Talarik Creek	August 29 to 8
William Mills	Volunteer/Lower Talarik Creek	August 29 to 8
Raymond Rotge	Volunteer/Lower Talarik Creek	September 8 to 22
James Ahlsten	Volunteer/Lower Talarik Creek	September 8 to 15
Stephen Johnson	Volunteer/Lower Talarik Creek	September 15 to 22
Ronald Evans	Volunteer/Lower Talarik Creek	September 22 to 29
R. Eric Minard	Volunteer/Lower Talarik Creek	September 22 to 29

## SECTION II: SPORT FISHING EFFORT

Comprehensive estimates of sport fishing effort for the SWMA were first made in 1977 and published in the Statewide Harvest Report (Mills 1979). Since that time, substantial increases in sport fishing effort have taken place in the SWMA. Prior to 1990, annual effort levels might best be described as stair-stepped growth (Figure 2). Since 1990 growth has been more continuous.

Note, all estimates of effort from 1995-1997 presented in this report are preliminary and are likely to be revised in the future.

From 1977 to 1982, effort averaged 31,563 angler-days in Southwest Alaska (Table 1). During this period, sport fishing effort was increasing an average of 3,161 angler-days per year, and the SWMA accounted for an average of 2.3% of the statewide total. Growth during this period was about 10% per year; about half the rate observed statewide.

A significant increase in effort was estimated for the period 1983 to 1989 when sport fishing effort more than doubled to an average 71,914 angler-days per year (Table 1). During this period, effort grew at an average of only 1,092 angler-days per year, contributing an average of 3.5% to the total sport fishing effort statewide.

Most recently, a third leap occurred when the effort surpassed the 100,000 angler-day level in 1990, with an estimated 104,699 angler-days (Table 1). Rather than stabilizing since 1990, there has been a steady increase in effort each year, averaging 5% annually since 1990. Effort reached the highest level yet in 1997, at 143,002 angler-days (Howe et al. 1998). During the period 1993-1997, the SWMA has contributed an average of 5% of the total effort statewide.

Some of the growth may be a response to the increased publicity associated with the creation of several National Wildlife refuges in the early 1980s. Increased effort may also be the result of improving local facilities and infrastructure such as roads, stores, airports, and air transportation. It is apparent that interest in sport fishing in Southwest Alaska has grown considerably, and the area is accounting for an increasing portion of the total sport fishing effort statewide. Sport fishing effort in the SWMA is expected to continue to increase during the next few years.

Sport fishing effort for some of the more popular locations is summarized in the following section of this report (Table 6, Figure 7). To warrant special recognition in this chapter, a fishery had to sustain an average of 2,500 angler-days during the last 5 years, or demonstrate a radical departure from historic performance.

### **ALAGNAK RIVER**

The Alagnak River, known locally as the Branch River, is located approximately 40 miles north of King Salmon in the Kvichak River drainage (Figure 1). Effort estimates for this fishery were first made in 1981 (Table 6). From 1981 through 1991, recreational fishing effort was erratic, peaking in 1986 at 7,628 angler-days, and bottoming out in 1988 at 1,182 angler-days. Effort during 1993 through 1997 climbed to an average of 12,362 angler-days (Figure 7). The large effort occurring in the Alagnak River makes it the third most popular fishing destination in Southwest Alaska, after the Nushagak/Mulchatna and Naknek rivers (Figure 7). Guided anglers using several river-based lodges or daily fly-in services account for over three-quarters of the sport effort on the Alagnak River (Dunaway 1994). The Alagnak River enjoys Wild and Scenic River status over the upper 55 miles of its length and hosts significant recreational fisheries for

**Table 6.-Sport fishing effort in angler-days in the waters of Southwest Alaska by fishery, 1977-1997.**

Drainage	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Eastern											
Ugashik	707	2,477	1,399	472	671	870	769	1,609	954 <sup>a</sup>	627 <sup>a</sup>	1,682
Egegik/Becharof	403	883	314	386	360	239	405	1,147 <sup>a</sup>	954 <sup>a</sup>	367 <sup>a</sup>	335 <sup>a</sup>
Naknek R.	4,675	5,600	5,691	9,967	10,863	11,393	14,786	14,914	15,311	18,057	17,152
Naknek L.	872	646	770	1,542	1,472	1,777	1,052	574	121 <sup>a</sup>	1,590	762
Bay of Islands							1,012	1,197	971	1,131 <sup>a</sup>	1,005
Brooks R.	1,195	1,464	1,163	1,971	1,391	2,423	2,976	1,821	1,474	2,752	2,784
Brooks L.											
American Cr.							61 <sup>a</sup>	175 <sup>a</sup>	364 <sup>a</sup>	122 <sup>a</sup>	335 <sup>a</sup>
King Salmon R.											
Kvichak R.	1,509	948	2,044	2,056	1,865	1,877	2,206	2,576	2,533	2,379	2,544
Copper R.	1,686	1,120	723	1,200	916	2,491	2,429	251 <sup>a</sup>	222 <sup>a</sup>	1,699 <sup>a</sup>	1,012 <sup>a</sup>
Alagnak R.					1,947	2,252	2,348	5,119	2,473	7,628	4,786
Newhalen R.	1,686	1,572	2,672	4,013	1,832	3,054	2,834	3,664	8,871	4,475	5,087
L Talarik Cr.	749	646	927	585	458	972	688	1,288 <sup>a</sup>	666	623 <sup>a</sup>	137 <sup>a</sup>
Lake Clark	3,748	2,910	3,128	2,342	2,519	2,286	4,777	1,322	1,511	4,248	824
Lake Iliamna							142 <sup>a</sup>	485 <sup>a</sup>	548 <sup>a</sup>	3,700	1,641
Kulik R.											
Tazimina R.											
Moraine Cr.											
Other	423	646	346	414	670	751	6,879	3,252	10,165	1,326	3,176
Subtotal	17,653	18,912	19,177	24,948	24,964	30,385	43,364	39,394	47,138	50,724	43,262

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**Table 6.-Page 2 of 4.**

Drainage	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	5-Year Average
Eastern											
Ugashik	528 <sup>a</sup>	998	1,383	1,627	2,001	1,918	2,315	905	2,918	3,325	2,276
Egegik/Becharof	1,037 <sup>a</sup>	779	1,193	1,033	1,634	888	1,771	1,083	881	1,087	1,142
Naknek R.	18,372	14,120	12,572	15,918	14,436	13,674	12,005	16,738	16,647	16,645	15,142
Naknek L.	1,710 <sup>a</sup>	914	2,148	981	2,411	844	700	931	1,107	554	827
Bay of Islands	564 <sup>a</sup>	1,527	2,620	2,259	2,838	1,160	747	857	798	840	880
Brooks R.	4,602	1,839	8,162	3,305	6,605	5,565	4,566	4,047	5,335	5,073	4,917
Brooks L.			680	813	2,262	900	642	1,289	404	523	752
American Cr.	31 <sup>a</sup>	343	1,550	491 <sup>a</sup>	939	1,659	1,833	609	750	1,346	1,239
King Salmon R.					918	190	605	1546 <sup>a</sup>	863 <sup>a</sup>	523 <sup>a</sup>	745
Kvichak R.	1,346	2,616	6,107	3,047	4,716	5,475	5,796	5,411	5,792	4,816	5,458
Copper R.	146 <sup>a</sup>	384	1,036	1,791	2,518	4,088	4,324	2,820	2,065	3,488	3,357
Alagnak R.	1,182 <sup>a</sup>	2,717	6,571	6,079	12,323	12,440	10,949	13,232	12,784	12,405	12,362
Newhalen R.	3,365	5,646	4,370	7,567	4,225	6,428	5,790	6,392	4,399	4,914	5,585
L Talarik Cr.	1,619 <sup>a</sup>	172 <sup>a</sup>	1,975	549	1,184	491	705	955	821	534	701
Lake Clark	255 <sup>a</sup>	2,697	3,377	3,292	1,803	2,596	3,084	4,148	1,373	4,030	3,046
Lake Iliamna	891	1,151	1,220	1,097	1,291	2,184	1,625	2,700	1,469	1,294	1,854
Kulik R.					886	1,555	851	621	2,321	634	1,196
Tazimina R.					437	343	627	800 <sup>a</sup>	275 <sup>a</sup>	275 <sup>a</sup>	464
Moraine Cr.					405	689	591	739	762	871	730
Other	5,339	2,557	5,407	6,846	5,478	6,712	8,310	7,956	7,148	9,853	7,996
Subtotal	40,987	38,460	60,371	56,695	69,310	69,799	67,836	73,779	68,912	73,030	70,671

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**Table 6.-Page 2 of 4.**

Drainage	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Central											
Nushagak	1,380	1,206	2,421	1,885	2,732	3,992	4,615	3,212	3,750	4,557	4,677
Mulchatna	1,296	1,486	1,431	1,057	1,145	1,228	2,672	2,175	3,266	2,920	2,735
Agulowak											
Agulukpak											
Wood River L.	3,549	2,843	1,745	3,884	1,701	3,139	5,040	3,497	2,460	3,012	2,325
Tikchik/Nuyakuk	959	1,465	582	2,071	2,241	1,058	1,579	1,171	1,693	292 <sup>a</sup>	684 <sup>a</sup>
Koktuli R.											
Other					0	356	3,036	1,105	643	1,245	3,711
Subtotal	7,184	7,000	6,179	8,897	7,819	9,773	16,942	11,160	11,812	12,026	14,132
Western											
Togiak	675	539	1,666	1,513	932	1,160	972	3,497	1,290 <sup>a</sup>	1,208	848 <sup>a</sup>
Goodnews							742	1,010 <sup>a</sup>	4,214	229 <sup>a</sup>	2,372 <sup>a</sup>
Kanektok							1,517	6,881	4,630	8,825	9,689
Arolik											
Other							20	344	243	61	
Subtotal	675	539	1,666	1,513	932	1,160	3,251	11,732	10,377	10,323	12,909
Northwestern											
Aniak							253 <sup>a</sup>	383 <sup>a</sup>	87 <sup>a</sup>	1,116 <sup>a</sup>	507 <sup>a</sup>
Kisaralik											
Kwethluk											
Other							2,682	1,149	694	703	1,920
Subtotal							2,935	1,532	781	1,819	2,427
Eastern	17,653	18,912	19,177	24,948	24,964	30,385	43,364	39,394	47,138	50,724	43,262
Central	7,184	7,000	6,179	8,897	7,819	9,773	16,942	11,160	11,812	12,026	14,132
Western	675	539	1,666	1,513	932	1,160	3,251	11,732	10,377	10,323	12,909
Northwestern							2,935	1,532	781	1,819	2,427
Total	25,512	26,451	27,022	35,358	33,715	41,318	66,492	63,818	70,108	74,892	72,730

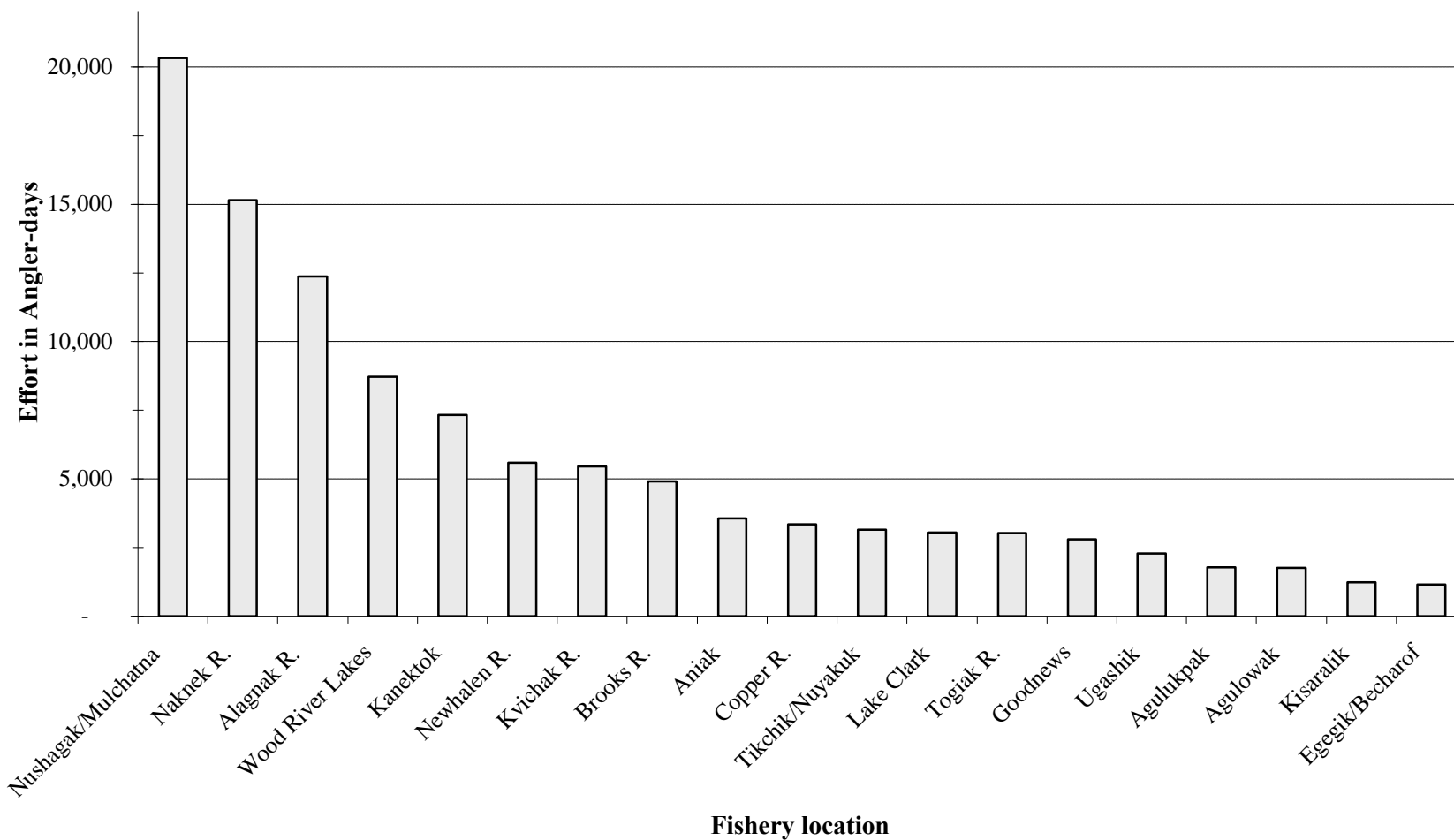
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**Table 6.-Page 4 of 4.**

Drainage	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	5-Year Average
Central											
Nushagak	5,039	3,980	7,978	11,351	10,031	14,168	15,460	16,410	21,589	11,917	15,909
Mulchatna	4,711	1,974	6,070	7,449	4,705	4,729	4,708	4,484	5,243	2,971	4,427
Agulowak										1,754 <sup>a</sup>	1,754
Agulukpak										1,780 <sup>a</sup>	1,780
Wood River L.	4,457	10,272	7,618	10,853	6,647	6,482	12,144	9,022	9,715	6,255	8,724
Tikchik/Nuyakuk	4,147	1,569	2,424	4,996	3,051	3,678	3,306	2,804	3,091	2,885	3,153
Koktuli R.					1,323	342	1,522	576 <sup>a</sup>	1,532	822 <sup>a</sup>	959
Other	1,486	1,882	4,624	4,041	864	1,098	3,629	4,235	3,679	5,268	3,582
Subtotal	19,840	19,677	28,714	38,690	26,621	30,497	40,769	37,531	44,849	33,652	37,460
Western											
Togiak	1,055 <sup>a</sup>	1,174	1,638	1,729	1,419	1,647	2,361	3,384	3,926	3,789	3,021
Goodnews	1,219 <sup>a</sup>	1,315	4,578 <sup>a</sup>	1,328	1,387	2,276	2,038	1,030	2,322	6,342	2,802
Kanektok	12,697	4,382	4,525	3,078	4,972	3,791	6,505	5,512	8,305	12,521	7,327
Arolik										1,475 <sup>a</sup>	1,475
Other	3,796	767	66	20	64	60	0	0	187	32	56
Subtotal	18,767	7,638	10,807	6,155	7,842	7,774	10,904	9,926	14,740	24,159	13,501
Northwestern											
Aniak	2,437 <sup>a</sup>	4,035	1,964	3,078	2,604	2,056	1,815	3,569	3,964	6,473	3,575
Kisaralik							1,463	369 <sup>a</sup>	1,525 <sup>a</sup>	1,578 <sup>a</sup>	1,234
Kwethluk					640	554	466 <sup>a</sup>	387 <sup>a</sup>	1,511 <sup>a</sup>	642 <sup>a</sup>	712
Other	377	3,231	2,843	2,966	3,500	3,620	2,350	2,905	3,433	3,468	3,155
Subtotal	2,814	7,266	4,807	6,044	6,744	6,230	6,094	7,230	10,433	12,161	8,430
Eastern	40,987	38,460	60,371	56,695	69,310	69,799	67,836	73,779	68,912	73,030	70,671
Central	19,840	19,677	28,714	38,690	26,621	30,497	40,769	37,531	44,849	33,652	37,460
Western	18,767	7,638	10,807	6,155	7,842	7,774	10,904	9,926	14,740	24,159	13,501
Northwestern	2,814	7,266	4,807	6,044	6,744	6,230	6,094	7,230	10,433	12,161	8,430
Total	82,408	73,041	104,699	107,584	110,517	114,300	125,603	128,466	138,934	143,002	130,061

Source: Mills 1977-1994, Howe et al. 1995-1998. Unless otherwise noted, these are published estimates for sites that garnered 12 or more responses in the Statewide Harvest Survey.

<sup>a</sup> Unpublished estimates from Statewide Harvest Survey for sites with less than 12 responses.



**Figure 7.-Five-year average (1993-1997) of the sport fishing effort (angler-days) at the major sport fisheries in Southwest Alaska.**

chinook, chum, and coho salmon as well as for rainbow trout, Dolly Varden/Arctic char, Arctic grayling, and northern pike. For the near term, sport fishing effort on the Alagnak River is likely to remain above 12,400 angler-days per year.

## **BROOKS RIVER**

The Brooks River, located in the heart of Katmai National Park and Preserve, has been a popular destination for sport fishermen since long before estimates of sport fishing effort were first made in 1977. The Brooks River has shallow, clear water with a moderate current, and flows northeast from Lake Brooks down to Naknek Lake. The Brooks River has long been recognized for its rainbow trout, sockeye and coho salmon, and Arctic grayling fisheries. During the recent 5-year period (1993-1997), Brooks River has supported an average of 4,917 angler-days of effort, making it the eighth most popular fishery in Southwest Alaska (Figure 7). At only 1.25 miles in length, the Brooks River supports more fishing pressure per mile than any other water in Southwest Alaska. Effort in 1997 was estimated to be 5,073 angler-days (Table 6).

Although effort remains high on the Brooks River, recent management actions on the part of the National Park Service have likely reduced growth in the fishery from what would have occurred if left unchecked. Several bear-angler incidents in recent years, where bears obtained fish from careless anglers, have resulted in restrictions on fishing area and bag limits, and led to the rule that anglers must leave fishing areas or at least stop fishing activity when bears are present. The bear problems, the park's difficulty with handling fish cleaning wastes, and the growing emphasis on bear viewing at Brooks River have led to additional restrictions that have a negative effect on the angling effort. Effort levels can be expected to remain between 4,000 and 7,000 angler-days per year.

## **KVICHAK RIVER**

The Kvichak River drains an extensive portion of the Bristol Bay watershed, most notably Lake Iliamna (Figure 1). Known primarily as the world's largest producer of sockeye salmon, the Kvichak drainage also supports significant recreational fisheries for rainbow trout, Dolly Varden/Arctic char, and Arctic grayling. Minor fisheries for coho salmon and lake trout also occur.

Annual effort jumped to a high level in 1990, when 6,107 angler-days of effort occurred at the Kvichak River (Table 6). Effort dropped slightly in 1991 (3,047 angler-days), but the effort during 1993 to 1996 remained stable at between 5,411 and 5,796 angler-days. The effort during 1997 dropped slightly, most likely due to the wide publicity of a diminished sockeye salmon run that year. Still, the 1993 to 1997 average annual effort was 5,458 angler-days (Table 6, Figure 7).

Expansion of the village airfield at Igiugig was completed in 1994. Improved aircraft access and parking will likely result in increased demand for fishing opportunity. Sport fishing effort is expected to remain stable or to slowly increase in the near future. Some recent evidence indicates that the rainbow trout fishery in August and September is increasing in popularity. An additional sport fishing lodge was built near Igiugig in 1997 and a large air terminal was built during 1998. Both developments may support additional growth in the nearby fisheries. Staff are working with village leaders and access program personnel to find ways to accommodate expected growth in a planned manner, which includes building walkways and boat launching areas.

## **LAKE CLARK**

Lake Clark is located in the eastern section of the management area and forms a major watershed in the Kvichak River drainage (Figure 1). Waters from Lake Clark flow into Sixmile Lake which drains into the Newhalen River. Lake Clark is within the confines of Lake Clark National Park and Preserve. The fjord-like bays and glacial-colored waters are the signature of this lake.

Sport fishing effort in Lake Clark has been estimated since 1977 (Table 6). Effort has generally remained approximately in the 2,000 to 4,000 angler-day range since 1977, although there have been notable exceptions of low effort in 1987 (824 angler-days), 1988 (255 angler-days), and 1996 (1,373 angler-days). The drop in effort in 1996, following a steadily increasing trend from 1992 to 1995, is difficult to explain, particularly with the 4,030 angler-days estimated in 1997. The average effort during 1993 to 1997 was 3,046 angler-days (Figure 7).

Most anglers target northern pike, grayling, lake trout and sockeye salmon. Rainbow trout are found very infrequently, if at all, in the glacial waters of Lake Clark. Because of its proximity to Anchorage, Lake Clark is likely to continue to grow as a fishing destination.

## **COPPER RIVER**

Located in the Eastern section of the management area, the 32-mile Copper River flows west from a series of small lakes into Intricate Bay on the southeastern shore of Iliamna Lake. The high quality rainbow trout fishery in this river was included in the Bristol Bay Trophy Fish area beginning in 1971, and in 1991 was designated a fly fishing only, catch-and-release special management area. The Copper River has a relatively abundant population of large, brightly-colored resident rainbow trout, as well as the more transient lake population of rainbow trout which enter the river in late August and September. Additional sport fish species present at least part of the year in Copper River include Dolly Varden, northern pike, and sockeye salmon. The scenic beauty of the area provides anglers either on float-trips or fishing from shore with a quality fly fishing experience.

Sport fishing effort has been estimated since 1977 and was generally below 2,000 angler-days until 1992 (Table 6). The angling effort during 1993 to 1997 ranged between 2,065 angler-days in 1996 to 4,324 angler-days in 1994, and the average effort during this period was 3,357 angler-days (Figure 7). The level of sport fishing effort is expected to remain steady or slightly increase over the next several years.

## **NAKNEK RIVER**

The Naknek River, located on the east side of Bristol Bay (Figure 1), supports the second most popular sport fishery within the SWMA, and accounts for about one-tenth of the total recreational angler effort expended in the SWMA each year. Effort is split between the upper river, where anglers target rainbow trout, Arctic grayling, Arctic char/Dolly Varden, and sockeye salmon, and the lower river, where they fish primarily for chinook and coho salmon.

Sport fishing effort on the Naknek River increased steadily from 1979 to 1988, from an average of approximately 5,000 angler-days annually during the late 1970s to the record 18,372 angler-days observed in 1988 (Table 6). From 1989 to 1994, effort ranged from 15,918 angler-days in 1991 to 12,005 angler-days in 1994. The reduction after 1988 was most likely due to angler response to more conservative regulations, the issuance of emergency order restrictions inseason, and a growing desire on the part of some fishermen to fish less crowded waters. Since 1995

angler effort has rebounded to over 16,000 angler-days annually, indicating that the fishery is expanding again in spite of more conservative regulations. During 1993 to 1997, the average angling effort was 15,142 angler-days per year (Figure 7). Sport fishing effort is expected to increase slowly over the next several years as new lodges and other services become available in the community of King Salmon.

## **NEWHALEN RIVER**

The Newhalen River connecting Six-Mile Lake to Lake Iliamna is the third most popular fishing destination in the Eastern section of the SWMA. Estimates of sport fishing effort were first made for the Newhalen River in 1977 and have been made annually since then (Table 6). During the period 1993 to 1997, sport fishing effort averaged 5,585 angler-days per year (Figure 7), and ranged from 6,428 angler-days in 1993 to 4,399 angler-days in 1996. Record effort was estimated in 1985 at 8,871 angler-days.

The attraction for most anglers is the opportunity to fish for abundant sockeye salmon which ascend the Newhalen River each summer. The bulk of the fishery occurs during a 4-week period starting in late June and continuing until late July. The sockeye returns to the Kvichak River drainage in 1996 through 1998 were extremely poor, resulting in reduced opportunity and success in harvesting fish. Extensive publicity of the poor runs further depressed angling effort. In addition to sockeye salmon, there is excellent rainbow trout and Dolly Varden fishing opportunity available in the upper reach of the Newhalen River as well as the tail water below the area known as the falls.

Sport fishing opportunity can be significantly enhanced through development of improved camping areas and public trail access from the Iliamna airport to the river. For several years staff have been working with local community leaders and land owners to improve access to the Newhalen River through the division's access program. When that project is completed, participation in the recreational fishery on the Newhalen may increase significantly. Most recently, leaders in the community of Newhalen have expressed interest in developing additional public access trails along the river near their community to attract anglers and bolster their economy.

## **NUSHAGAK AND MULCHATNA RIVERS**

The Nushagak and Mulchatna rivers are located in the central section of the SWMA (Figure 1) and together are the greatest producers of chinook, chum, coho, and pink salmon in Bristol Bay. Primary species of interest to sport fisherman include chinook, chum, and coho salmon as well as rainbow trout, Dolly Varden/Arctic char and Arctic grayling. Sport fishing effort has increased steadily since 1977 to reach a new peak of 26,832 angler-days in 1996 (Table 6). Most (75%) of the effort occurs in the Nushagak River, and together the two rivers account for about 14% of the total sport fishing effort in the SWMA (Figure 7).

Recreational fishing effort in the Nushagak River averaged 15,909 angler-days per year during 1993 to 1997, making it the most popular fishery in the SWMA. The 1997 estimate of 11,917 angler-days was about half the 1996 effort for this fishery and likely the result of inseason closures and the unpredictable chinook salmon fishery during 1996 and 1997. The Mulchatna River has averaged approximately 4,000 angler-days per year and since 1990 has remained relatively stable (Table 6).

Up to 35 commercial guiding services use the Nushagak/Mulchatna drainage and operate spike camps or store boats within the area. Recreational activity within the drainage was the focus of a major planning effort completed in July 1990, which resulted in the Nushagak and Mulchatna Rivers Recreation Management Plan (ADNR et al. 1990). Additionally, local village corporations now maintain a vigorous, and profitable, recreational land management program on their lands. As mentioned in the Management Plans section of this report, recent conveyances of Native lands, subsequent subdivision and sale of some Native lands, discoveries of mineral deposits, and prospects of accelerated development along these rivers has precipitated efforts to begin a watershed planning effort initiated by the Bristol Bay Native Association and local communities. These new developments may lead some large landholders to cap the number of trespass permits they sell, particularly to guides or other commercial operations.

### **WOOD RIVER LAKES, AGULOWAK AND AGULUKPAK RIVERS**

The Wood River Lakes system (Figure 1), a series of six large lakes connected by relatively swift short rivers, is located within the confines of the Wood-Tikchik State Park. Sport fishing opportunities have attracted anglers in ever-increasing numbers. Anglers target rainbow trout, Arctic char, Arctic grayling, northern pike and a variety of salmon species. Because of the diverse fishery resources, sport fishing continues throughout most of the open water season. During the 5-year period from 1993 to 1997, effort averaged 8,724 angler-days per year (Figure 7), or little less than 7% of the areawide total.

As the nation's largest state park, the area receives a great deal of publicity, and unguided use of the fishery resources is on the rise. The area is also the base for several major fishing lodges which offer fly-out fishing trips, often to remote reaches of the Wood River Lakes system. A number of new lodges are being constructed just outside the boundaries of the park. Taken together, the guided and unguided components are significant in these waters and effort is expected to increase substantially in the future.

Once included in the Wood River Lakes, estimates of effort, catch and harvest, effort on the two most popular rivers in the system, the Agulukpak and Agulowak, are now assessed separately beginning in 1997 (Table 6). Note the estimates for 1997 are based on less than 12 responses to the statewide harvest surveys, making these estimates extremely imprecise; little previous data are available for comparison. Still these rivers are very popular with local as well as visiting anglers. Use levels, crowding and quality of experience, boating safety, and potential impacts on the fishery populations are becoming issues for these waters. As the Wood Tikchik Park plan review progresses (See Management Plans section), these two rivers are likely to be focal points of discussions.

### **TIKCHIK LAKES/NUYAKUK RIVER SYSTEM**

The Tikchik Lakes/Nuyakuk River system includes six lakes and connecting river in the northern part of the Wood/Tikchik State Park (Figure 1). The Nuyakuk River starts at the outlet of Tikchik Lake, and flows east 43 miles to join the Nushagak River. The Nuyakuk River has a moderate current, and clear and deep water, making it a popular destination for anglers seeking a quality float-trip experience. Sport fishing opportunities have been increasing in this area, just as they have in the nearby Wood River Lakes. Anglers target rainbow trout, lake trout, Arctic char, Arctic grayling, and a variety of salmon species.



Angling effort in the Tikchik/Nuyakuk River during 1977 to 1991 ranged from a low of 582 angler-days in 1979 to a high of 4,996 angler-days in 1991 (Table 6). The estimates of effort in 1986 and 1987 (292 and 684 angler-days, respectively) were based on less than 12 responses to the statewide harvest survey. During 1993 to 1997, angling effort remained relatively steady with an average annual effort of 3,153 angler-days (Figure 7), and ranging from 2,804 angler-days in 1995 to 3,678 angler-days in 1993.

## **GOODNEWS RIVER**

The Goodnews River (Figure 1) is located in the Western section of the management area and is within the Togiak National Wildlife Refuge. The Goodnews River consists of three river forks which drain approximately 1,000 square miles. The Goodnews River (North Fork) issues from Goodnews Lake and flows approximately 25 miles before leaving the refuge, and continues another 22 miles to Goodnews Bay. The Middle Fork is a 42-mile-long tributary that parallels the North Fork, joining near the outlet. The upper 27 miles of the Middle Fork are located on the refuge. The South Fork is the smallest of the three tributaries and is approximately 25 miles in length, 10 miles of which are within the refuge. The waters of the Goodnews drainage support abundant Dolly Varden/Arctic char, rainbow trout, Arctic grayling, and all five species of Pacific salmon. Of the salmon species, coho salmon are the most popular with recreational anglers fishing these waters.

Estimates of sport fishing effort were first available in 1983. Estimates for the Goodnews River based on 12 or more responses to the statewide harvest survey were made for 1985, 1989, and 1991 through 1997. For the remaining 5 years (1984, 1986-1988, and 1990), estimates of sport effort have been made but are based on less than 12 responses, making these estimates extremely imprecise. Effort increased dramatically in 1997 for an all-time high estimate of 6,342 angler-days, roughly 30% greater than the previous high estimate from 1990, and about 44% above the recent 5-year average. For the period 1993 to 1997, sport fishing effort on the Goodnews River averaged 2,802 angler-days, accounting for about 2% of the total effort in Southwest Alaska. Until 1997, USF&WS staff estimated about 66% of the effort occurred in the lower portion of the Goodnews River, below the wilderness boundary and outside the refuge. This river system has become very popular for float trips. It is likely a larger proportion of the 1997 effort occurred within the refuge boundaries by unguided anglers.

In May of 1991, the Togiak Refuge Public Use Management Plan was adopted by the U.S. Fish and Wildlife Service for the Goodnews River (USF&WS 1991). The plan addressed guided and unguided use on the Goodnews River, and allowed 10 sport fishing operators to provide commercial services within the wilderness portion of the drainage. Commercial activities below the wilderness area are not controlled by the Service under this plan. The intent of this plan was to maintain the 1990 level of guided sport fishing effort through the 1995 season. Under this plan, private recreational effort throughout the system and professional guided effort below the refuge boundary is currently unlimited.

## **KANEKTOK RIVER**

The Kanektok River (Figure 1), located south of Bethel and within the Togiak National Wildlife Refuge, is a 93-mile clearwater river that became popular with sport fishermen starting about 1983. Since 1983, sport fishing effort increased rapidly to a peak of 12,697 angler-days in 1988 (Table 6). Fishing effort during 1989 to 1995 declined to between 4,000 and 6,000 angler-days. Effort increased quickly in 1996 and 1997 to 8,305 and 12,521 angler-days, respectively. During 1993 to 1997, annual effort has averaged 7,327 angler-days (Figure 7), or nearly 6% of the effort within the SWMA area. Approximately 60% of the total effort occurs on the lower 20 miles of the river, where fishermen target chinook, chum, and coho salmon. The upper 73 miles support primarily rainbow trout, Arctic grayling, and Dolly Varden fisheries.

The Togiak Refuge Public Use Management Plan adopted in 1991 by the USF&WS addressed guided and unguided use on the Kanektok River (USF&WS 1991). That plan established maximum daily use levels for commercially guided visitors within the wilderness section of the Refuge. This plan is not likely to result in significant changes in sport fishing effort on the Kanektok River. Under this plan, private recreational effort throughout the system and professional guided effort in the lower 20 miles of the river are currently unlimited.

## **TOGIAC RIVER**

The Togiak River, within the confines of the Togiak National Wildlife Refuge on the western side of Bristol Bay (Figure 1), supports significant runs of chinook and coho salmon as well as abundant Dolly Varden/Arctic char and rainbow trout stocks. The river is fished primarily by fly-in and float-trip anglers, as well as clients from two river-based lodges. Angler effort on the Togiak River during 1977 to 1992 was relatively stable at levels of approximately 500 to 1,500 angler-days, with the exception of 1984 when effort peaked at 3,497 angler-days. From 1993 effort steadily increased from 1,647 angler-days to 3,926 angler-days in 1996, then essentially leveled off in 1997 (Table 6). The average effort during this period was 3,021 angler-days (Figure 7). As of 1997, effort at the Togiak River represented only 2.6% of the SWMA total recreational fishing effort. Under the Public Use Management Plan adopted in 1991 by the U.S. Fish and Wildlife Service (USF&WS 1991), sport fishing effort, particularly guided effort in the wilderness section of the Refuge, was limited to moderate growth during the next several years by increasing the number of client-days allocated to each guide. One facet that has changed in this drainage is the fact that increasing numbers of anglers are using the smaller tributaries of the Togiak River to fish grayling and rainbow trout.

## **NORTHWESTERN FISHERIES**

The least developed fisheries in the SWMA are found in the Northwestern section. The waters in this section are extremely remote with few but growing number of facilities catering to sport fishermen. Estimates of effort were first calculated for the waters of the Northwestern section in 1983 (Table 6). During 1993 to 1997, effort averaged 8,430 angler-days per year or 6% of the effort for the whole management area (Table 1). The most popular river in this section is the Aniak River where growth has been rapid and the 1997 effort was nearly double the levels of the 2 previous years. The Aniak River fisheries now account for approximately 50% of the Northwestern section total effort. During 1993 to 1997, the angling effort on the Aniak River averaged 3,575 angler-days (Figure 7). Chinook and coho salmon, rainbow trout, Dolly Varden/Arctic char and Arctic grayling are the most commonly harvested species in the Northwestern section sport fisheries.

### SECTION III: CHINOOK SALMON FISHERIES

The following discussions focus on six significant recreational chinook salmon fisheries found in the SWMA. A significant fishery refers to a particular drainage, river, or portion of a waterway where a large proportion of the area's total effort and/or harvest for a single species occurs. Fisheries requiring particular management attention or which have been designated as special management areas are generally regarded as significant fisheries.

Chinook salmon stocks throughout the management area significantly increased in abundance from the late 1970s through the early 1980s. Then, from about 1984 to 1990, chinook salmon abundance in western Alaska returned to more normal levels. Harvests of chinook salmon have loosely followed the trends in abundance, reaching a peak in 1987 at 18,622 fish, declining through 1990, then growing to an all-time high of 19,333 fish in 1994 (Figure 8). Chinook salmon typically account for about 30% of the recreational salmon harvest in Southwest Alaska. The 1997 sport harvest for the area was 11,999 fish and, unlike 1996, within the range of harvests common since 1991 (Table 7). Approximately 7% to 8% of all the chinook salmon killed in the SWMA are taken by sport fishermen.

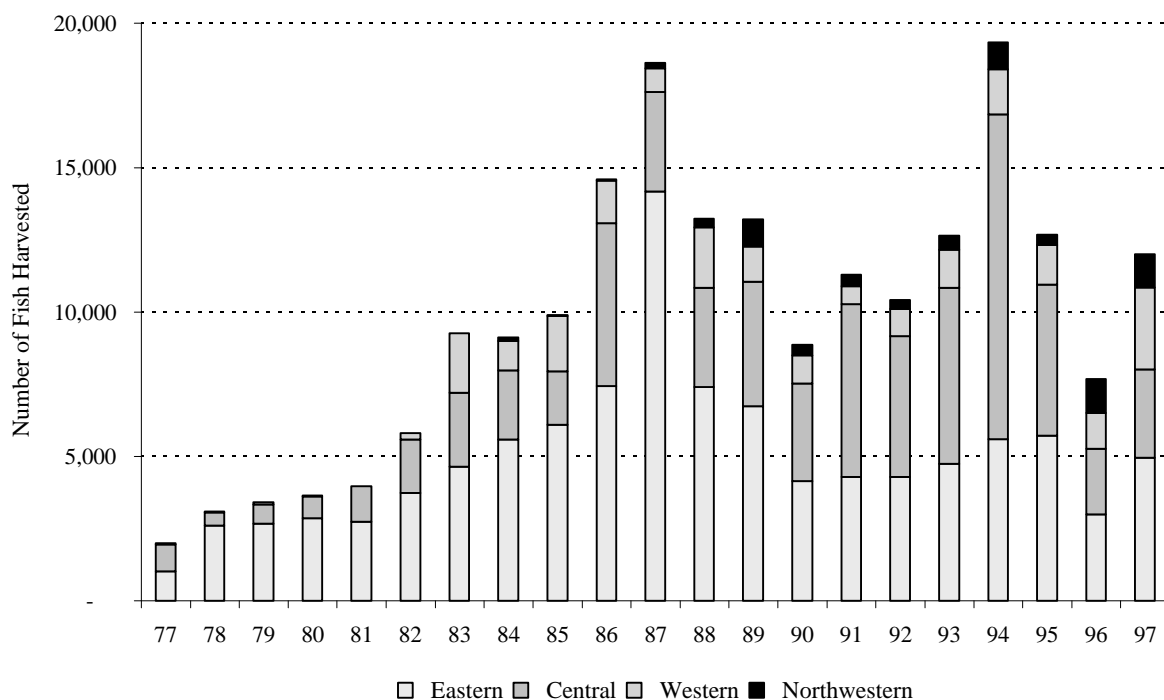
The peak of the recreational chinook salmon fishery occurs from mid-June to mid-July in the lower reaches of the Alagnak, Nushagak, Naknek, Togiak, and Kanektok rivers, as well as several smaller waters (Figure 9). The chinook salmon sport fisheries of the area, like the sport fisheries for most species, are fished primarily by guided fishermen. With few exceptions, the guided to unguided ratio is about 3 to 1, and the retention rates (the number of fish kept in relation to the total caught) are usually 50% or less.

Since 1960, bag limits for chinook salmon have become increasingly conservative and complex. The most conservative and sweeping regulatory changes to the area chinook salmon fisheries were adopted during the November and December 1997 Board of Fisheries meetings. A Bristol Bay-wide annual limit of 5 chinook salmon was adopted. In the Nushagak River drainage anglers were further restricted to an annual limit of 4 chinook salmon and the daily bag limits in several major fisheries were reduced slightly. Season closures of varying dates were adopted for all Bristol Bay, Kuskokwim Bay and lower Kuskokwim River waters to protect spawning chinook salmon. The following is a chronology of the bag limit regulatory changes affecting chinook salmon sport fisheries in Southwest Alaska. Additional drainage specific regulations have been adopted and will be described later in this section.

Effective Year	Bristol Bay drainages	Kuskokwim Bay area and Kuskokwim River drainage
1965	10 salmon (all species combined) per day, no size limit	15 salmon per day, no size limit
1972	5 chinook per day, only 2 may be over 26 inches	no change
1976	5 chinook per day, only 2 may be over 28 inches	no change

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Effective Year	Bristol Bay drainages	Kuskokwim Bay area and Kuskokwim River drainage
1985	no change	5 chinook per day, no size limit
1988	3 chinook per day, only 2 may be over 28 inches	<u>Kuskokwim Bay area (excluding Kuskokwim River):</u> 3 chinook per day, only 2 may be over 28 inches <u>Kuskokwim River drainage:</u> 1 chinook per day, no size limit
1995	no change	<u>Kuskokwim Bay area and Kuskokwim River drainage:</u> 3 chinook per day, only 2 may be over 28 inches
1998	Daily bag and possession limits on several waters reduced to less than 3 per day, only 2 over 28 inches. Annual limit of 5 chinook salmon. Spawning closures for all waters.	Bag limits no change July 25 spawning season closures for all waters.



**Figure 8.-Sport harvest of chinook salmon from the Eastern, Central, Western, and Northwestern sections of the Southwest Alaska sport fish management area, 1977 to 1997.**

**Table 7.-Sport harvest of chinook salmon from the waters of Southwest Alaska by fishery, 1977-1997.**

Drainage	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Eastern											
Ugashik	0	0	0	0	0	0	0	64	0 <sup>a</sup>	0 <sup>a</sup>	322
Egegik/Becharof	4	0	0	0	0	0	0	148 <sup>a</sup>	0 <sup>a</sup>	37 <sup>a</sup>	0 <sup>a</sup>
Naknek R.	1,005	2,406 <sup>b</sup>	2,669 <sup>b</sup>	2,729	2,581	3,264	3,545	4,524	5,038	6,462 <sup>b</sup>	11,419 <sup>b</sup>
Naknek L.	0	0	0	0	0	0	0	0	0 <sup>a</sup>	15	0
Bay of Islands							0	0	62	0 <sup>a</sup>	0
Brooks R.	0	0	0	0	0	0	0	42	25	0	64
Brooks L.											
American Cr.							0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>
King Salmon R.											
Kvichak R.	9	210	10	129	64	252	420	100	57	68	191
Copper R.	0	0	0	0	0	0	0	37 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>
Alagnak R.					97	220	252	661	757	680	1,969
Newhalen R.	0	0	0	0	0	0	0	0	0	0	0
L Talarik Cr.	0	0	0	0	0	0	0	0 <sup>a</sup>	0	0 <sup>a</sup>	0 <sup>a</sup>
Lake Clark	0	0	0	0	0	0	0	0	0	0	0
Lake Iliamna							0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	34	54
Kulik R.											
Tazimina R.											
Moraine Cr.											
Other							430	0	161	128	149
Subtotal	1,018	2,616	2,679	2,858	2,742	3,736	4,647	5,576	6,100	7,424	14,168

-continued-

**Table 7.-Page 2 of 4.**

Drainage	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	5-Year Average
Eastern											
Ugashik	0 <sup>a</sup>	52	120	113	72	150	106	19	20	59	71
Egegik/Becharof	588 <sup>a</sup>	78	80	0	16	9	20	9	49	22	22
Naknek R.	5,380 <sup>b</sup>	3,879 <sup>b</sup>	3,250 <sup>b</sup>	3,115	2,633	2,603	3,692	4,153	1,936	3,464	3,170
Naknek L.	62 <sup>a</sup>	26	0	9	69	0	0	9	0	24	7
Bay of Islands	0 <sup>a</sup>	0	0	18	25	18	67	45	29	0	32
Brooks R.	0	0	0	0	44	0	0	19	0	12	6
Brooks L.				0	0	0	0	0	0	0	0
American Cr.	0 <sup>a</sup>	0	0	0 <sup>a</sup>	0	0	0	0	0	0	0
King Salmon R.					182	19	219	124 <sup>a</sup>	88 <sup>a</sup>	300 <sup>a</sup>	150
Kvichak R.	0	681	143	44	16	250	90	175	98	48	132
Copper R.	0 <sup>a</sup>	277	0	22	0	0	0	9	39	0	10
Alagnak R.	1,243 <sup>b</sup>	1,333 <sup>b</sup>	474	790	1,160	1,515	1,048	891	673	858	997
Newhalen R.	0	25	0	22	0	0	30	9	0	0	8
L Talarik Cr.	0 <sup>a</sup>	0 <sup>a</sup>	0	0	0	0	0	0	0	0	0
Lake Clark	0 <sup>a</sup>	0	0	0	0	0	0	0	0	0	0
Lake Iliamna	0	50	55	11	17	0	60	0	0	0	12
Kulik R.					0	0	0	0	0	0	0
Tazimina R.					0	0	0	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0
Moraine Cr.					0	0	0	0	0	0	0
Other	124	338	31	142	57	173	267	255	59	165	184
Subtotal	7,397	6,739	4,153	4,286	4,291	4,737	5,599	5,717	2,991	4,952	4,799

-continued-

**Table 7.-Page 3 of 4.**

Drainage	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Central											
Nushagak	402	151	312	611	929	1,436	1,615	1,534	1,517	1,780 <sup>b</sup>	1,371 <sup>b</sup>
Mulchatna	521	291	342	146	291	367	388	786	292	3,534	1,860
Agulowak											
Agulukpak											
Wood River L.	0	0	0	0	0	0	0	62	14	0	0
Tikchik/Nuyakuk	0	0	0	0	0	0	0	0	29	0 <sup>a</sup>	27 <sup>a</sup>
Koktuli R.											
Other					0	42	545	12	0	350	191
Subtotal	923	442	654	757	1,220	1,845	2,548	2,394	1,852	5,664	3,449
Western											
Togiak	62	35	78	34	0	231	535	46 <sup>b</sup>	925 <sup>b</sup>	618 <sup>b</sup>	338 <sup>b</sup>
Goodnews							31	52 <sup>a</sup>	323	0 <sup>a</sup>	125 <sup>a</sup>
Kanektok							1,511	922	667 <sup>b</sup>	844 <sup>b</sup>	375 <sup>b</sup>
Arolik											
Other							0	12	0	0	
Subtotal	62	35	78	34	0	231	2,077	1,032	1,915	1,462	838
Northwestern											
Aniak							0 <sup>a</sup>	39 <sup>a</sup>	12 <sup>a</sup>	49 <sup>a</sup>	49 <sup>a</sup>
Kisaralik											
Kwethluk											
Other							0	78	12	0	118
Subtotal							0	117	24	49	167
Eastern	1,018	2,616	2,679	2,858	2,742	3,736	4,647	5,576	6,100	7,424	14,168
Central	923	442	654	757	1,220	1,845	2,548	2,394	1,852	5,664	3,449
Western	62	35	78	34	0	231	2,077	1,032	1,915	1,462	838
Northwestern							0	117	24	49	167
Total	2,003	3,093	3,411	3,649	3,962	5,812	9,272	9,119	9,891	14,599	18,622

-continued-

**Table 7.-Page 4 of 4.**

Drainage	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	5-Year Average
Central											
Nushagak	2,383	2,807	1,594	3,586	3,688	4,815	8,871	4,476	2,006	2,375	4,509
Mulchatna	403	754	1,409 <sup>b</sup>	1,894	813	965	1,675	402	84	163	658
Agulowak										0 <sup>a</sup>	0
Agulukpak										0 <sup>a</sup>	0
Wood River L.	557	104	160	173	80	97	435	93	10	24	132
Tikchik/Nuyakuk	31	52	80	71	178	101	60	73	10	0	49
Koktuli R.					76	18	20	0 <sup>a</sup>	44	0 <sup>a</sup>	16
Other	62	598	137	263	39	106	181	193	118	502	220
Subtotal	3,436	4,315	3,380	5,987	4,874	6,102	11,242	5,237	2,272	3,064	5,583
Western											
Togiak	0 <sup>a</sup>	234	445 <sup>b</sup>	284	271	225	663	581	402	1,163	607
Goodnews	91 <sup>a</sup>	68	27 <sup>a</sup>	26	23	81	163	41	157	62	101
Kanektok	1,910	884	503	316	656	1,006	751	739	689	1,616	960
Arolik										0 <sup>a</sup>	0
Other	91	37	0	0	0	0	0	0	0	0	0
Subtotal	2,092	1,223	975	626	950	1,312	1,577	1,361	1,248	2,841	1,668
Northwestern											
Aniak	164 <sup>a</sup>	738	285	214	172	300	437	279	592	544	430
Kisaralik							148	9 <sup>a</sup>	20 <sup>a</sup>	55 <sup>a</sup>	58
Kwethluk					31	0	19 <sup>a</sup>	0 <sup>a</sup>	59 <sup>a</sup>	55 <sup>a</sup>	27
Other	146	201	82	187	110	200	311	84	496	488	316
Subtotal	310	939	367	401	313	500	915	372	1,167	1,142	819
Eastern	7,397	6,739	4,153	4,286	4,291	4,737	5,599	5,717	2,991	4,952	4,799
Central	3,436	4,315	3,380	5,987	4,874	6,102	11,242	5,237	2,272	3,064	5,583
Western	2,092	1,223	975	626	950	1,312	1,577	1,361	1,248	2,841	1,668
Northwestern	310	939	367	401	313	500	915	372	1,167	1,142	819
Total	13,235	13,216	8,875	11,300	10,428	12,651	19,333	12,687	7,678	11,999	12,870

Source: Mills 1977-1994, Howe et al. 1995-1998. Unless otherwise noted, these are published estimates for sites that garnered 12 or more responses in the Statewide Harvest Survey.

<sup>a</sup> Unpublished estimates from Statewide Harvest Survey for sites with less than 12 responses.

<sup>b</sup> Estimates from onsite creel survey.



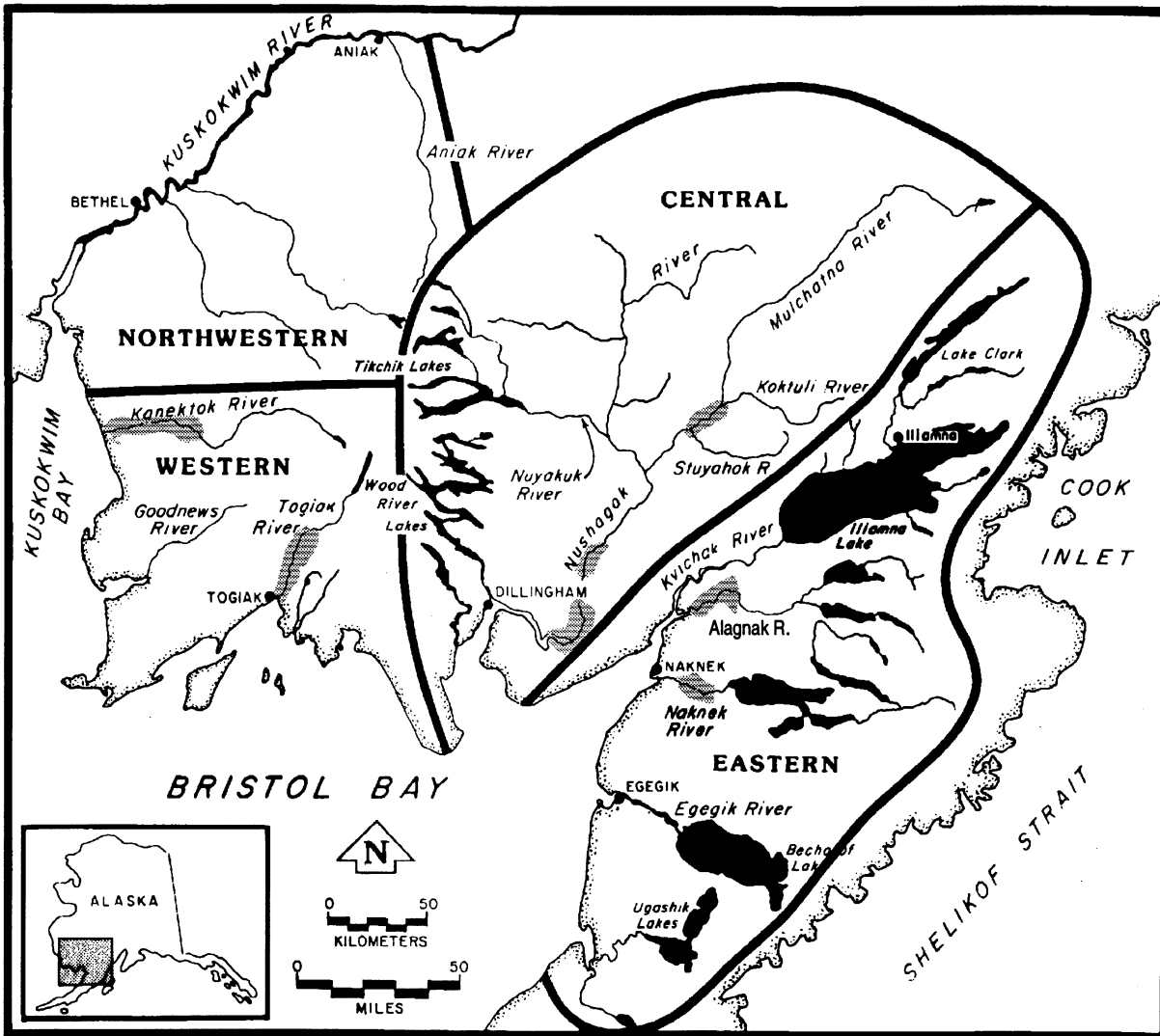


Figure 9.-Popular chinook salmon sport fisheries in Southwest Alaska.

## ALAGNAK RIVER

### Fishery Description

The chinook salmon fishery in the Alagnak River occurs in the lower 12 miles of the river and peaks in mid to late July, which is roughly 2 weeks later than other chinook salmon fisheries in the area (Dunaway 1994). Chinook salmon returning to the Alagnak are typically larger than those found in other systems. Effort is primarily a guided (80%), nonresident venture (Dunaway 1990a, 1994). Most anglers either fly in with float-equipped aircraft for 1-day trips, or base out of one of the several lodges located along the river. Retention rates average approximately 20%, typical of most of the area's chinook fisheries.

## Historical Performance

The largest estimated annual harvest of chinook salmon from the Alagnak River was 1,969 fish in 1987, and the lowest estimated harvest was 97 fish in 1981 (Table 7). The recent 5-year average (1993-1997) harvest of chinook in the Alagnak River was 997 fish. There is an obvious decreasing trend in harvest since 1993, despite very significant increases in sport fishing effort (Table 6), and above average escapements (Table 8). It may be that self-imposed bag restrictions set by the main lodges on the river are contributing to the reduced annual harvest.

**Table 8.-Unexpanded escapement counts for chinook salmon in the Alagnak River, 1970 to 1998.**

Year	Index Count
1970	5,250
1971	1,420
1972	2,256
1973	824
1974	1,596
1975	6,620
1976	7,593
1977	3,634
1978	11,650
1979	No survey
1980	2,930
1981	2,430
1982	3,400
1983	2,980
1984	6,090
1985	3,920
1986	3,090
1987	2,420
1988	4,600
1989	3,650
1990	1,720
1991	2,531
1992	3,042
1993	10,170
1994	8,480
1995	6,860
1996	9,885
1997	15,210
1970-1997 Average	4,972
1998	4,148

Until 1988 the daily bag and possession limits for chinook salmon in the Alagnak River were 5 fish, 2 over 28 inches in length. From 1989 through 1997, the limits were 3 per day and in possession, 2 over 28 inches in length. During the November 1997 Board of Fisheries meeting, users of the Alagnak expressed their concern for the high levels of effort on chinook salmon. In response and in addition to the 5 fish annual limit and July 31 season closure, the Board established a daily bag and possession limit of 3 fish, only 1 of which could exceed 28 inches in length (ADF&G 1998b). Terminal tackle was restricted to single-hook artificial lures only.

## **Management**

Sport harvests and effort are estimated through the statewide harvest survey and reported by Mills (1979-1994) and Howe et al. (1995-1999). Commercial and subsistence harvests are monitored by the Commercial Fisheries Division and are reported in their Annual Management Report series (ADF&G 1998a). Commercial harvests are reported for the Naknek/Kvichak district which is a mixed-stock fishery composed of Kvichak, Naknek, and Alagnak River stocks. It is not possible to separate the commercial harvests by river of origin. Sport Fish Division has conducted significant monitoring and stock assessment projects on the Alagnak River in the recent past (Brookover 1989a, Dunaway 1990a and 1994).

A chinook salmon escapement goal has not been established for Alagnak River stocks. Escapement of chinook salmon in the Alagnak drainage has been indexed by the use of fixed-wing aerial surveys each year since 1970, with the exception of 1979 (Table 8). Unexpanded counts of chinook salmon, called index counts, average 4,972 fish (1970 to 1997). Escapements for the last 5 years have been well above the long-term average (Table 8).

Management concerns for chinook stocks of the Alagnak River drainage center on our inability to estimate exploitation rates. Allocation of commercial catches from the Naknek/Kvichak district to the river of origin are not possible, and the lack of inseason assessment of escapement makes it impossible to effectively manage this stock. Run timing of chinook stocks to the Alagnak coincides with peak periods of commercial sockeye salmon fishing in the Naknek/Kvichak district. When sockeye returns are sufficient to allow for liberal fishing schedules, the potential for substantial incidental harvest of the Alagnak chinook stocks exists. When sockeye returns to the Kvichak are down, as they have been the last several years, then escapement of chinook salmon into the Alagnak appears to benefit.

## **1998 Season**

The 1998 chinook salmon return was the product of escapements observed in 1991 through 1994. Two of the parent year escapements (1991 and 1992) were below average and 1993 and 1994 were well above average (Table 8).

Since parental escapements were split between well above and below average, we anticipated an average or better return in 1998. Fishery performance inseason was reported to be fair with periods of slow fishing mixed with occasional periods of excellent catch rates. Unlike the previous seasons, water temperatures and levels were relatively normal and should not have affected the salmon behavior significantly. Unexpectedly, commercial fishing time in the Kvichak district was minimal after the first few days of July when the sockeye salmon run was below expected levels. However, commercial fishing resumed in mid July. This later timing of the commercial fishery may have intercepted some of the Alagnak River chinook salmon return. Anglers reported fair fishing but noticeable interruptions in chinook salmon passage when the

commercial fishery was open. Aerial index counts in August found an average escapement, with an index count of 4,148 chinook salmon (Table 8).

### **Management Objectives**

Explicit management objectives have not yet been developed for this fishery. Aerial survey data exist to develop a goal and it is likely that a biological escapement goal (BEG) will be developed for this fishery within the next several years.

### **1999 Outlook**

The 1999 return will be the product of escapements observed between 1992 through 1995. The 1992 escapement was slightly below the long-term average of nearly 5,000 chinook salmon, but not of great concern. Of the other three parental escapements, 1993 and 1994 were nearly or more than double the average escapement, while 1995 was slightly above average. Therefore we expect the 1999 return to be sufficient to provide a normal sport fishery in 1999. The 1999 commercial fishery in the Naknek/Kvichak district may be less restricted than in 1996 through 1998, and has the potential to influence the abundance of chinook salmon in the Alagnak River. As in 1998, chinook salmon availability in the Alagnak River is more likely to approach the long-term average, unlike the unusual escapements enjoyed in 1993, 1996, and 1997. Angling effort on this river in 1999 can be expected to remain at the high levels of recent seasons. Given the anticipated return for 1999, no inseason adjustments are anticipated for the fishery.

## **NAKNEK RIVER**

### **Fishery Description**

The Naknek River (Figure 9) chinook salmon sport fishery commences May 1 and continues through July 31, when it closes by regulation to protect spawning fish. The 3 peak weeks are from June 22 to July 14. Effort is concentrated in a 12-mile stretch of the Naknek River adjacent to the community of King Salmon. This fishery is one of the most popular sport fisheries in the area, and accounts for roughly 25% of all the chinook salmon harvested by sport fishermen in the SWMA. This fishery has a significant amount of unguided effort, reasonably good catch rates, and a high retention rate. The results of a 1995 creel survey showed, for example, that 61% of the fishermen interviewed were unguided, and of the estimated catch of 4,238 chinook salmon, 3,537 or 83% were kept (Dunaway and Fleischman 1996a).

### **Historical Performance**

A period of significantly increasing sport effort resulted in increased harvests of chinook salmon from 1977 to 1987 (Table 9). Distribution of the harvest between user groups has remained relatively stable over the last 22 years. During the recent 5 years, 34% of the harvest has been taken by sport fishermen, and the remainder of the harvest was split between commercial (51%) and subsistence (15%) users (Table 9).

Effort in the Naknek River has been approaching the record levels last observed in 1986-88. The 1997 estimated effort of 16,645 angler-days (Table 6) represents effort for all species, although much of that effort is directed toward chinook salmon. Since the late 1980s increasingly restrictive regulations on the sport fishery have been effective in balancing escapement with sport harvest. From 1993 through 1997, sport harvests have averaged 3,170 fish per year, very close to

**Table 9.-Chinook salmon commercial, subsistence, and sport harvest plus escapement for the Naknek River fishery, 1970-1998.**

Year	Harvest				Escapement
	Commercial <sup>a</sup>	Subsistence <sup>b</sup>	Sport	Total	Index <sup>c</sup>
1970	19,037	300	2,730	22,067	4,145
1971	10,254	200	2,417	12,871	2,885
1972	2,262	400	1,668	4,330	2,791
1973	951	600	1,000	2,551	2,536
1974	480	870	1,700	3,050	
1975	964	576	427	1,967	3,452
1976	4,064	675	800	5,539	7,131
1977	4,373	1,093	1,005	6,471	
1978	6,930	1,023	2,406	10,359	
1979	10,415	1,044	2,669	14,128	
1980	7,517	1,421	2,729	11,667	
1981	11,048	738	2,581	14,367	4,271
1982	12,425	933	3,264	16,622	8,610
1983	8,955	851	3,545	13,351	7,830
1984	8,972	754	4,524	14,250	4,995
1985	5,697	979	5,038	11,714	
1986	3,188	730	6,462	10,380	3,917
1987	5,175	1,067	11,419	17,661	4,450
1988	6,538	922	5,380	12,840	11,730
1989	6,611	740	3,879	11,230	2,710
1990	5,068	777	3,250	9,095	7,000
1991	3,584	1,008	3,115	7,707	4,391
1992	5,724	1,034	2,633	9,391	2,691
1993	7,477	1,361	2,603	11,441	8,016
1994	6,016	1,680	3,692	11,388	9,678
1995	5,084	1,199	4,153	10,859	4,960
1996	4,047	1,484	1,936	7,467	5,076
1997	1,288	1,400	3,464	6,152	10,453
<hr/>					
All Years Avg.	6,219	924	3,232	10,375	5,624
Percent	60%	9%	31%		
<hr/>					
1993 to 1997 Avg.	4,782	1,425	3,170	9,377	7,637
Percent	51%	15%	34%		
<hr/>					
1998 <sup>d</sup>	2,444	1,966	3,534	7,944	5,505
Percent	31%	25%	44%		

<sup>a</sup> Naknek Kvichak district commercial harvests likely include Naknek, Alagnak, and Kvichak stocks. The harvests reported above for Naknek River stocks are therefore considered maximums.

<sup>b</sup> Previous tables presented rounded estimates; this table presents actual raw counts from returned permits, 1975 to 1996. 1970-1986 data based on permits issued in King Salmon, Naknek and South Naknek; 1987-1998 data based on Naknek watershed fishing sites as indicated on permit.

<sup>c</sup> Actual raw counts made from fixed-wing aerial surveys.

<sup>d</sup> 1998 estimates are preliminary. Commercial take includes 273 chinook salmon recorded as personal use from the commercial catch.

the long-term average for the fishery. Escapement for the same period has averaged 7,637 (Table 9), in excess of the goal of 5,000 chinook salmon. The increasing participation may require additional regulations to maintain the balance of sport harvest and spawning escapement. Adjustments to the commercial fishery may be worth consideration as well.

## **Management**

Sport harvests and effort are estimated through the statewide harvest survey and reported by Mills (1979-1994) and Howe et al. (1995-1999). Commercial and subsistence harvests are monitored by the Commercial Fisheries Division and are reported in their Annual Management Report series (ADF&G 1998a, 1999b). The Sport Fish Division has conducted significant monitoring and stock assessment projects on a routine schedule (Dunaway and Fleischman 1996a, Coggins 1992, Coggins and Bingham 1993, Dunaway and Bingham 1991, Minard 1987a and 1989a, Minard and Brookover 1988a). Commercial, subsistence, and sport harvest data along with escapement information are reported under one cover in (ADF&G 1998a).

Since 1986 the sport fishery has been managed to achieve a 5,000 chinook salmon index on the spawning grounds (Table 10). Escapement of chinook salmon is estimated by fixed-wing aerial surveys of the four primary spawning areas of Paul's Creek, King Salmon Creek, Big Creek, and the mainstem of the Naknek River during the presumed peak of spawning. Aerial counts are left unexpanded and are considered minimum estimates of escapement. Results of the escapement surveys indicate the mainstem of the Naknek River, along with Big Creek, comprises approximately 88% of the observed escapement (Table 10). Recent escapements have generally met or exceeded the escapement goal, but those in the smaller tributaries remain a source of concern.

Concern over low escapements and increasing sport harvest prompted the Alaska Board of Fisheries in 1987 to adopt a regulation package addressing Naknek River chinook salmon. The key elements of that package included:

1. establishing a season for chinook salmon (May 1 to July 31),
2. artificial-lure-only designation, and
3. reduction in bag and possession limits to 3 per day, 1 of which may be over 28 inches .

Beginning in the early 1990s, increasing portions of Paul's and King Salmon creeks were closed to chinook salmon fishing to protect spawning stocks in these waters. In 1995, the confluence of King Salmon Creek and the Naknek River were closed to angling to protect an important holding area for chinook salmon.

In 1997, closures to chinook salmon angling in Paul's and King Salmon Creek were clarified, and an annual limit of 5 chinook salmon per angler was adopted for this fishery. The annual harvest limit was Bristol Bay-wide and required anglers to record the date and location of each chinook salmon taken.

**Table 10.-Unexpanded aerial escapement counts for chinook salmon in the Naknek River and drainage, 1970-1998.**

Data Source	Year	Mainstream Naknek	Paul's Creek	King Salmon Creek	Big Creek	Total
A	1970	3,060		260	825	4,145
A	1971	1,639	52	704	490	2,885
A	1972	351	156	1,224	1,060	2,791
A	1973	1,315		115	1,106	2,536
A	1974		91	495	860	
A	1975	2,250	144	279	779	3,452
A	1976	5,950	31	180	970	7,131
A	1977	4,830		1,860		
A	1978					
A	1979					
A	1980	300	17		30	
A	1981	2,890		591	790	4,271
A	1982	5,360	340	980	1,930	8,610
A	1983	2,860	290	460	4,220	7,830
A	1984	790	400	385	3,420	4,995
B	1985	700	170	500	2,900	4,270
C	1986	2,200	73	102	1,542	3,917
C	1987	2,800	7	290	1,353	4,450
C	1988	7,380	150	600	3,600	11,730
C	1989	1,700	50	100	860	2,710
C	1990	4,500	150	350	2,000	7,000
C	1991	1,655	121	275	2,340	4,391
C	1992	1,550	88	158	895	2,691
C	1993	5,520	86	700	1,710	8,016
C	1994	5,970	203	974	2,531	9,678
C	1995	2,790	26	239	1,905	4,960
C	1996	2,965	157	312	1,576	5,010
C	1997	7,520	248	902	1,783	10,453
1970-1997						
	Average	3,154	139	521	1,659	5,473
	Percent	58%	3%	10%	30%	
	1998	2,150	210	1060	2,085	5,505
	Percent	39%	4%	6%	31%	

Data sources:

A Russell 1985.

B Bucher 1987.

C ADF&G, Divisions of Commercial Fisheries and Sport Fish, Aerial Surveys, 1986 through 1998.

## **Management Objectives**

The Naknek River chinook salmon sport fishery is managed for a biological escapement goal (BEG) of 5,000 spawners, indexed by aerial survey. While managing for the BEG, consideration is also given to maintaining the historical distribution of spawners within the four major spawning areas.

### **1998 Season**

The 1998 chinook salmon return was the product of escapements observed in 1991 through 1994 (Table 10). The parent-year escapement of 1993 was well below average, while 1991 was slightly below desired levels. The escapements of 1993 and 1994 were well above the 5,000 fish goal and were expected to produce strong returns of 4- and 5-year old fish.

Preliminary data from Howe et al. (1999) estimate 3,534 chinook salmon were harvested during the 1998 sport fishery, slightly above the recent average or slightly greater. Commercial catches were well below average for the fishery and totaled 2,444 (Table 9). Subsistence catches were above average, accounting for 1,966 fish (Table 9). The increase in the subsistence take may be due to better reporting of personal use fish taken in the commercial fishery, and a response to the annual sport harvest limit.

The index of 5,505 chinook salmon met the escapement goal (Table 9). Escapement in the mainstem was slightly below average, and above average in each of the tributary streams.

### **1999 Outlook**

The 1999 Naknek River chinook salmon return will be the product of the 1992 through 1995 escapements. Escapement in 1992 was half the escapement goal of 5,000 fish; 1993 and 1994 were well above the goal; and 1995 achieved the goal. Based on the parent year escapements and assuming normal survival, we anticipate an average to above average return in 1999. Strong 5 and 6 year components are expected given the strong escapements of 1993 and 1994. The Naknek River upstream from the ADF&G marker at Rapids Camp remains restricted to single-hooks with a point-to-shank gap of 1/4 inch or less until August 1.

## **NUSHAGAK AND MULCHATNA RIVERS**

### **Fishery Description**

The Nushagak and Mulchatna rivers support significant recreational, commercial, and subsistence chinook salmon fisheries. Within the drainage, there are three areas of concentrated sport effort (Figure 9): the lower Nushagak River near the village of Portage Creek, the middle section of the Nushagak River in the vicinity of the village of Ekwok, and the mid-section of the Mulchatna River between the Stuyahok and Koktuli rivers. In the last couple years, the lower river fishery has begun to expand upriver towards Ekwok and the two areas are beginning to merge into a single, extended fishery. In addition, there has been increasing angling activity in the vicinity of the outlet of the Mulchatna River and the village of Koliganek. Although sport fishing for chinook salmon does occur in some of the tributaries of the drainage, the overall impact of that activity in terms of harvest is considered slight.

### **Historical Performance**

Nushagak/Mulchatna chinook salmon total returns (Table 11) averaged 135,000 fish during the period 1966 to 1977. During the next 7 years (1978 to 1984), returns averaged an unprecedented



**Table 11.-Chinook salmon commercial, subsistence, and sport harvest plus escapement for the Nushagak drainage, 1966-1998.**

Year	Commercial Harvest	Subsistence Harvest	Sport Harvest			Total Harvest	Spawning Escapement <sup>c</sup>	Total Run
			Nush <sup>a</sup>	Mul <sup>b</sup>	Total			
1966	58,184	3,700				61,884	40,000	101,884
1967	96,240	3,700				99,940	65,000	164,940
1968	78,201	6,600				84,801	70,000	154,801
1969	80,803	7,100				87,903	35,000	122,903
1970	87,547	6,300				93,847	50,000	143,847
1971	82,769	4,400				87,169	40,000	127,169
1972	46,045	4,000				50,045	25,000	75,045
1973	30,470	6,600				37,070	35,000	72,070
1974	32,053	7,900				39,953	70,000	109,953
1975	21,454	7,100				28,554	70,000	98,554
1976	60,684	6,900				67,584	100,000	167,584
1977	85,074	5,200	402	521	923	91,197	65,000	156,197
1978	118,548	6,600	151	291	442	125,590	130,000	255,590
1979	157,321	8,900	312	342	654	166,875	95,000	261,875
1980	64,958	11,800	611	146	757	77,515	141,000	218,515
1981	193,461	11,500	929	291	1,220	206,181	150,000	356,181
1982	195,287	12,100	1,436	367	1,803	209,190	147,000	356,190
1983	137,123	11,800	1,615	388	2,003	150,926	161,730	312,656
1984	61,378	9,800	1,534	786	2,320	73,498	80,940	154,438
1985	67,783	7,900	1,546	292	1,838	77,521	115,720	193,241
1986	65,783	12,600	1,780	3,534	5,314	83,697	35,200	118,897
1987	45,983	12,428	1,398	1,860	3,258	61,669	78,217	139,886
1988	16,648	10,187	2,414	403	2,817	29,652	50,803	80,455
1989	17,637	8,122	2,859	754	3,613	29,372	73,095	102,467
1990	14,812	12,407	1,674	1,409	3,083	30,302	57,549	87,851
1991	19,718	13,627	3,657	1,894	5,551	38,896	96,378	135,274
1992	47,563	13,588	3,866	889	4,755	65,906	76,334	142,240
1993	62,976	17,709	4,916	983	5,899	86,584	88,568	175,152
1994	119,480	15,490	8,931	1,695	10,626	145,596	83,328	228,924
1995	79,943	13,701	4,549	402	4,951	98,595	79,147	177,742
1996	72,011	15,941	2,016	128	2,144	90,096	44,864	134,960
1997	64,294	15,318	2,375	163	2,538	82,150	82,000	164,150
1966-1997 Avg.	74,445	9,719	2,332	835	3,167	87,331	79,121	166,452
Percent	85%	11%			4%			
1993-1997 Avg.	79,741	15,632	4,557	674	5,232	100,604	75,581	176,186
Percent	79%	16%			5%			
1998 <sup>d</sup>	108,651	12,258	5,348	307	5,655	126,564	112,398	238,962
Percent	86%	10%			4%			

<sup>a</sup> Nushagak River and tributaries excluding the Mulchatna River and tributaries.

<sup>b</sup> Mulchatna River and tributaries.

<sup>c</sup> Escapement estimate in 1966 was based on tower count data and an estimate of total escapement accounted for by the tower counts; 1967 based on tower count data, minimal aerial survey coverage, and general run strength indicators; 1968-1970, 1972-1981, and 1997 estimates were based on comprehensive aerial survey coverage; 1971 and 1982-85 estimates based on the correlation between index counts and total escapement estimates when aerial surveys were complete; 1986-1996, and 1998 estimates are sonar estimates minus subsistence and sport harvest above sonar, assuming 50% of the total Nushagak River and all Mulchatna sport harvest occurs upstream of the sonar. Source: Bucher 1987, ADF&G 1986, ADF&G 1999b.

<sup>d</sup> 1998 harvest estimates are preliminary. Subsistence is a preliminary estimate of harvest by site as of 3/1/99 upstream of sonar = 2,270 and total subsistence harvest of kings in the Nushagak watershed = 12,258 fish.

293,500 fish. Since 1985, returns have declined to normal levels of production, averaging approximately 125,000 fish. Chinook salmon stocks in the Nushagak/Mulchatna drainage are considered to be stable at average, or slightly above average, levels.

Harvest of chinook salmon by the recreational fishery averaged 3,167 fish from 1977 through 1997, and for 1993 through 1997 averaged 5,232 fish (Table 11). Distribution of the harvest between user groups, as shown in Table 11, shows the majority (85%) of the harvest has historically been taken by commercial fishermen, with an additional 11% taken by the subsistence fishery, and 4% by sport anglers. By comparison, the recent 5-year average suggests a redistribution of the harvest has occurred, with the subsistence fishery taking 16% (Table 11).

## **Management**

Sport harvest and effort are estimated through the statewide harvest survey and reported by Mills (1979-1994) and Howe et al. (1995-1999). Commercial and subsistence harvests are monitored by the Commercial Fisheries Division and are reported in their Annual Management Report series (ADF&G 1998a, 1999a). Sport Fish Division has conducted significant monitoring and stock assessment projects in the recent past (Minard 1987b, Minard and Brookover 1988c, Dunaway et al. 1991, Dunaway and Bingham 1992a, Dunaway and Fleischman 1995b, and Minard et al. 1998).

Under the Nushagak and Mulchatna Chinook Salmon Management Plan (5 AAC 06.361, adopted 1/92; amended 12/94 and 11/97) chinook salmon are managed to attain an inriver return of 75,000 fish which provides 65,000 spawning fish, a reasonable opportunity to harvest chinook salmon in the inriver subsistence fishery, and a guideline harvest in the sport fishery of 5,000. If the inriver return exceeds 75,000, then the guideline sport harvest does not apply. If the inriver return falls below 55,000, then restrictive actions are called for in the sport fishery. If the inriver return falls below 40,000, the sport fishery is to be closed.

Chinook salmon escapement into the Nushagak and Mulchatna rivers was first estimated by aerial survey from 1966 through 1986. Starting in 1987, side scan sonar was used to estimate chinook salmon inriver return to the Nushagak drainage. The sonar is considered a marked improvement over the aerial survey program since it gives real-time estimates of escapement on which management decisions can be based. In 1997, the sonar apparently underestimated the chinook salmon escapement by half. This was evidenced by escapement estimates based on aerial surveys of between 80,000 and 85,000, compared to the sonar estimate of only 26,000 chinook salmon. The under count was attributed to extremely low water conditions and accompanying high water temperatures, which caused the distribution of fish to shift to outside the ensonified area of the river (Miller 1998). In the recent 5 years (1993-1997), spawning escapements have averaged 75,581 chinook salmon (Table 11), very close to the desired 75,000 inriver run goal.

Since 1972, declining stock abundance and increasing sport effort have prompted restrictive actions on the inshore commercial and sport fisheries. A chronology of significant regulation changes follows:

- 1965. Bristol Bay bag and possession limits were 10 salmon (all species combined) daily.
- 1972. Bag limits for the Bristol Bay area were dropped to 5 chinook salmon per day and in possession, of which only 2 could be over 26 inches in length.
- 1987. Bag and possession limits dropped to 3 per day, only 2 over 28 inches in length.
- 1990. Sport season established from January 1 to July 25 upstream of and including the Iowithla River. Spawning season closure adopted to afford drainage-wide protection to spawning chinook salmon stocks.
- 1992. Gear restricted to single-hook artificial lures for the portion of the Mulchatna River between the Koktuli and Stuyahok rivers.
- 1992. Nushagak and Mulchatna Chinook Salmon Management Plan (5 AAC 06.361) is adopted, capping the sport harvest at 5,000 fish and establishing an escapement projection of 65,000 as the trigger for inseason restrictions in the sport fishery.
- 1994. Nushagak and Mulchatna Chinook Salmon Management Plan (5 AAC 06.361) is amended, setting the sport allocation as a guideline harvest rather than a cap.
- 1997. Nushagak and Mulchatna Chinook Salmon Management Plan (5 AAC 06.361) was amended, by establishing an escapement projection of 55,000 chinook salmon below which inseason restrictions in the sport fishery must be imposed. Daily bag and possession limit is reduced to 2 chinook per day, only 1 over 28 inches. Guides were prohibited from retaining any species of fish while guiding (bay-wide). An annual harvest limit of 4 chinook salmon was adopted for Nushagak/Mulchatna drainage. The Kokwok River and the Nushagak River upstream from its confluence with Harris Creek were closed to angling for chinook salmon. A July 31 spawning season closure was adopted for the Nushagak River downstream from the Iowithla River outlet. The commercial fishery was to be managed to allow pulses of the run to enter the Nushagak River untouched.

Bag and possession limits for Nushagak chinook salmon are currently 2 per day, 1 of which may be over 28 inches (ADF&G 1998b).

Uplands along much of the Nushagak River are privately owned. A recreational land management program is administered by the Land Department of Choggiung Limited, an Alaska Native-owned corporation. Since its inception in the mid-1980s, this program has grown to include the lands of the adjoining villages of Ekwok, New Stuyahok and, in some years, Koliganek. This system has matured into a sound and profitable venture for the corporations. Private and commercial land use permits sold by the program allow anglers access to desirable camp sites while engaged in recreational fishing and hunting. Sales and estimates of camper nights are useful indicators of sport effort. Overnight use has risen from 1,365 camper nights in 1989 to 4,278 camper nights in 1997 (Nelson 1997).

## **Management Objectives**

The Nushagak/Mulchatna chinook salmon fishery is managed in accordance with the Nushagak and Mulchatna Chinook Salmon Management Plan. Specific objectives are to: (1) manage the commercial fishery to ensure an inriver return of 75,000 fish; (2) manage the inriver fisheries for a biological escapement goal of 65,000 spawners; and (3) manage the sport harvest for a guideline harvest of 5,000 fish.

## **1998 Season**

The 1998 Nushagak district chinook salmon total return forecast was 159,00 fish, which is 11% greater than the recent 10-year average. Harvest potential in the sport fishery, given an inriver abundance of 75,000 fish and the new regulation package, was expected to stay within the 5,000 chinook salmon guideline harvest level.

Chinook salmon began to appear in the Nushagak River in early to mid May. Upriver villagers began to report abundant fish and good subsistence catches early in the season. Good passage of chinook salmon was observed as soon as the Commercial Fisheries Division's sonar counter was installed near Portage Creek on June 9. Escapement continued to be quite good throughout the season. The final escapement estimate was 117,495 chinook salmon past the sonar counter, well above the 75,000 inriver goal (ADF&G 1999b). The total return, including all harvests, was estimated to be 238,962 chinook salmon (Table 11).

The commercial fishery was managed according to the new provisions in the plan which directed the department to allow unfished pulses of chinook salmon into the Nushagak River. This system was an effort to address the concern for escapement quality expressed during the 1996 and 1997 seasons. It is believed that the fish escaping to spawn would be of a more "normal" distribution of size, sex, and age structure than was observed in previous seasons. The better than expected run indications allowed relatively liberal commercial fishing time while assuring that the 75,000 inriver goal was easily met. Total commercial harvest for the season was 108,651 chinook salmon, the second best commercial take since 1983 (Table 11).

The subsistence fishery was successful and though the total harvest was less than some seasons, all needs appear to have been met. A total of 12,258 chinook salmon were reportedly taken in the subsistence fishery (Table 11).

With the very early return of chinook salmon, fish were abundant in the river when the sport fishery got under way in mid June. By late June it was clear the inriver goal would be met easily with no restrictions to the angling public. On some occasions, chinook salmon entered the river in strong numbers even while a commercial fishery was open. All users of this resource were quite happy and well supplied with chinook salmon. By July 6 the inriver goal had been met, the sport fishery remained very good, and it was clear the sport fishery would not be restrained by the 5,000 fish guideline harvest. In addition, it appeared the new regulatory package for the sport fishery was working as anticipated. A total of 5,655 chinook salmon are estimated to have been harvested in the sport fishery (Table 11, Howe et al. 1999). Most surprising is the relatively low harvest of only 307 chinook salmon in the Mulchatna drainage (Table 11, Howe et al. 1999). This may be a response to the numerous closures and disruptions to this fishery in the previous few seasons.

In late July through mid August, Sport and Commercial Fisheries staff flew aerial escapement surveys of the major spawning areas in the drainage. Poor weather and water conditions delayed

some surveys until past the peak spawning period and counts are likely to have been less than ideal. In addition, water depths and clarity were more “normal” than the previous years, yielding counts very close to the long term average. The “normal” conditions were the impetus for the department’s adoption of the sonar counter as a better means of assessing sockeye salmon run strength in this system. A total of 18,120 chinook salmon were observed in eight of the nine tributaries (Table 12). Continued aerial surveys of the major tributaries may be worthwhile given the problems encountered in 1997. The surveys also give the department a sense of the spawning distribution within the system.

The actual return of chinook salmon to the Nushagak drainage in 1998 was probably best estimated by the sonar counter. Throughout the season, the sonar staff conducted test netting in the middle sections of the river that are not reached by the sonar system. This work showed that some chinook salmon swim beyond the range of the sonar counter, particularly in the section of the river immediately offshore of the sonar range. At this time the department has no means to quantify the proportion of the escapement that is not counted by the sonar. The department is looking into ways to assess the fish that pass offshore.

### **1999 Outlook**

The 1999 chinook salmon forecast for the Nushagak and Mulchatna drainages is 214,000 fish with a potential range from 161,000 to 267,000 fish. The 1999 forecast is 36% greater than the recent 10-year average and slightly less than the 1998 actual run. Age class 5- and 6-year-old fish are expected to dominate the return. Management of the 1999 sport fishery will be according to the Nushagak Chinook Salmon Management Plan. The plan calls for managing the commercial fishery to allow 75,000 chinook salmon into the river. Commercial fishing periods are to be timed such that the escapement is like the naturally occurring composition of size classes. This direction came from the Alaska Board of Fisheries and is intended to address concerns about escapement quality. The Sport Fishery is to be managed to provide for a spawning escapement of 65,000 chinook salmon and a guideline harvest of 5,000 fish. To remain within the 5,000 fish guideline the daily bag and possession limit is 2 chinook salmon per day of which 1 may be larger than 28 inches in length. Additionally there is a seasonal limit of 4 chinook salmon taken from the Nushagak River watershed, and harvests must be recorded immediately. Guides may not retain fish while guiding.

Given the 1999 forecast of 214,000 and the success of the management plan in 1998, it appears that the issues of escapement quality and stability in the sport fishery have been addressed. It appears unlikely that inseason emergency order adjustments will be made in the 1999 sport fishery.

## **KANEKTOK RIVER**

### **Fishery Description**

The majority of the chinook salmon fishery occurs in the lower 12 miles of the Kanektok River (Figure 9) in the vicinity of the village of Quinhagak. The fishery peaks in late June and early July, slightly earlier than the fisheries further to the east. Because of its relatively small size,

**Table 12.-Historic aerial escapement index counts of chinook salmon in selected streams in the Wood, Nushagak and Mulchatna drainages, 1966 to 1998.**

Wood R.		Nushagak and Mulchatna drainages								
	Muklung	Iowithla	Kokwok	Klutispaw	Salmon	Stuyahok	Koktuli	Nushagak	Mulchatna	
Year	River	River	River	River	River	River	River	River <sup>a</sup>	River <sup>b</sup>	Total
1967	350	200				2,500	3,300			6,000
1968 <sup>c</sup>	750	850		310	1,000	2,470	4,220	970	510	10,330
1969	520	580	90 <sup>d</sup>	90	670	1,220	1,600	910 <sup>e</sup>	680 <sup>e</sup>	5,840
1970	590	700	110 <sup>d</sup>	320	1,060	1,900	1,500	1,180 <sup>e</sup>	880 <sup>e</sup>	7,650
1971	280	390	80 <sup>d</sup>							470
1972	150	170		280	900	610	1,450	690 <sup>e</sup>	510 <sup>e</sup>	4,610
1973				380	1,470	1,220	950			4,020
1974 <sup>c</sup>	1,010	860	60 <sup>d</sup>	440	2,000	2,300	3,920	2,340	2,160	14,080
1975	660	1,040	270	670	2,900	2,530	4,080	2,320 <sup>e</sup>	1,710 <sup>e</sup>	15,520
1976 <sup>c</sup>	840	1,110	560	1,180	3,510	3,750	6,710	1,760	2,580	21,160
1977 <sup>c</sup>	940	840	310	650	1,420	2,700	4,630	820	1,980	13,350
1978 <sup>c</sup>	1,170	1,700	520	1,940	4,450	4,400	6,730	5,850	2,280	27,870
1979 <sup>c</sup>	950	1,350	170	1,040	2,150	3,570	6,260	2,880	1,730	19,150
1980	1,600	2,310 <sup>e</sup>	70	970	4,500	7,200	10,620	5,300 <sup>e</sup>	3,920 <sup>e</sup>	34,890
1981	2,260	2,630	70	1,650	2,950	5,980	9,960	4,960 <sup>e</sup>	3,670 <sup>e</sup>	31,870
1982	790	2,520	90	350	8,390	3,640	6,780	4,380 <sup>e</sup>	3,240 <sup>e</sup>	29,390
1983 <sup>c</sup>	1,830	2,430	350	2,090	5,990	2,910	8,060	6,330	4,260	32,420
1984 <sup>c</sup>	1,300	1,080	110	770	1,780	2,010	2,860	2,800	1,060	12,470
1985	1,250	1,610	60	1,950	4,460	2,690	4,940	3,420 <sup>e</sup>	2,390 <sup>e</sup>	21,520
1986	230	270		170	380	520	290	380 <sup>e</sup>	260 <sup>e</sup>	2,270
1987	160	140		340	570	280	440	390 <sup>e</sup>	270 <sup>e</sup>	2,430
1988	430	550		780	1,380	2,040	2,580	1,800	710	9,840
1989						190 <sup>d</sup>	240 <sup>d</sup>			430
1990 <sup>f</sup>	60	120		340	900	830	3,390	630	800	7,010
										-
1995	210	170	75	630	3,150	660	2,230			6,915
1996 <sup>f</sup>										-
1997 <sup>g</sup>	1,240	640		1,190	8,900	1,460	6,220	21,818	1,496	41,724
1998	150 <sup>h</sup>	<sup>h</sup>	150 <sup>h</sup>	2,620	5,510	550 <sup>h</sup>	720	8,390	180 <sup>h</sup>	18,120
Mean	789	1,011	185	881	2,933	2,313	4,026	3,651	1,694	16,694

Source: Russell et al. 1992. Table 27, page 43.

Browning et al. 1998, Weiland et al. 1999.

<sup>a</sup> Nushagak River from the outlet of the Nuyakuk R. to outlet of King Salmon River (to Big Bend in 1997).

<sup>b</sup> Mulchatna River from the outlet of Mosquito Creek to the outlet of the Koktuli River (to outlet of Stuyahok R. in 1997).

<sup>c</sup> Years in which aerial survey coverage was complete.

<sup>d</sup> Minimal estimate - very poor survey conditions.

<sup>e</sup> These numbers are proportional estimates rather than aerial live counts; estimates are based on the mean proportion of fish counted in these areas during year in which aerial coverage was complete.

<sup>f</sup> No surveys conducted from 1991 through 1994, or in 1996.

<sup>g</sup> Survey conditions in 1997 excellent, water very clear and very low.

<sup>h</sup> Surveys conducted 8/11/98, well past peak of spawning; Iowithla River not surveyed. Remaining surveys conducted 7/29/98, before peak of spawning.

clear water, and consistent returns of chinook salmon, the Kanektok River is considered one of the finest chinook salmon sport fisheries in western Alaska.

### **Historical Performance**

Harvest estimates for the Kanektok River sport fishery date back to 1983 and range from a high of 1,910 fish in 1988 to a low of 316 fish in 1991 (Table 13). The average sport harvest for the recent 5 years (1993 to 1997) was 960 fish (Table 13). Distribution of the harvest between user groups has been relatively unchanged over the past 30 years. The commercial fishery accounts for over 80% of the harvest, with the subsistence fishery taking an additional 14%, and the sport fishery harvesting about 5% (Table 13). The sport fishery is characterized by a relatively low retention rate (43% in 1986, 20% in 1987, 25% in 1991), a high proportion of guided anglers (62% in 1991, 32% in 1994), and a low incidence of bait as terminal tackle (Minard 1987c, Minard and Brookover 1988b, Dunaway and Bingham 1992b, Dunaway and Fleischman 1995a).

### **Management**

Sport harvest and effort are estimated through the statewide harvest survey and reported by Mills (1979-1994) and Howe et al. (1995-1999). Commercial and subsistence harvests are managed by the Commercial Fisheries Division in Bethel and are reported in their Annual Management Report series (Burkey et al. 1997, 1998, 1999a). The Sport Fish Division has conducted significant monitoring and stock assessment projects in the recent past (Minard 1987c, Minard and Brookover 1988b, Dunaway and Bingham 1992b, Dunaway and Fleischman 1995a). The U.S. Fish and Wildlife Service has collected age and size data from chinook salmon spawning in the Kanektok River since 1994 (Lisac and MacDonald 1995, MacDonald 1996).

Escapement of chinook salmon into the Kanektok River is estimated by aerial survey from fixed-wing aircraft. Counts are left unexpanded and represent minimum escapement estimates. Since 1960, the escapement goal of 5,800 chinook salmon has been reached or exceeded in most years.

A chronology of significant regulation changes follows:

- 1965. Kuskokwim drainage chinook salmon limit was set at 15 per day, 30 in possession.
- 1985. Bag and possession limits for chinook salmon were dropped to 5 chinook salmon with no size limit.
- 1988. Bag and possession limits were again dropped to the current limit of 3 chinook per day, of which only 2 can be 28 inches or larger.
- 1997. May 1 to July 25 season established to protect spawning fish. Gear restricted to single-hook artificial lures only year-round.

### **Management Objectives**

The Kanektok River chinook salmon fishery is managed to achieve escapement of 5,800 chinook salmon, indexed by aerial survey. The department is working with the local community to develop a weir to allow better assessment of salmon escapement into the drainage.

**Table 13.-Chinook salmon commercial, subsistence, and sport harvest plus escapement for the Kanektok River, 1960 to 1998.**

Year	Harvest				Escapement	
	Commercial <sup>a</sup>	Subsistence	Sport	Total	Index <sup>b</sup>	Total Run <sup>c</sup>
1960	0			0	6,047	6,047
1961	4,328			4,328		4,328
1962	5,526			5,526	935	6,461
1963	6,555			6,555		6,555
1964	4,081			4,081		4,081
1965	2,976			2,976		2,976
1966	278			278	3,718	3,996
1967	0	1,349		1,349		1,349
1968	8,879	2,756		11,635	4,170	15,805
1969	16,802			16,802		16,802
1970	18,269			18,269	4,112	22,381
1971	4,185			4,185		4,185
1972	15,880			15,880		15,880
1973	14,993			14,993	814	15,807
1974	8,704			8,704		8,704
1975	3,928			3,928		3,928
1976	14,110			14,110		14,110
1977	19,090	2,012		21,102	5,787	26,889
1978	12,335	2,328		14,663	19,180	33,843
1979	11,144	1,420		12,564		12,564
1980	10,387	1,940		12,327	6,172	18,499
1981	24,524	2,562		27,086	15,900	42,986
1982	22,106	2,402		24,508	8,142	32,650
1983	46,385	2,542	1,511	50,438	8,890	59,328
1984	33,633	3,109	922	37,664	12,182	49,846
1985	30,401	2,341	667	33,409	13,465	46,874
1986	22,835	2,682	844	26,361	3,643	30,004
1987	26,022	2,663	375	29,060	4,223	33,283
1988	13,883	2,508	1,910	18,301	11,140	29,441
1989	20,820	3,048	884	24,752	7,914	32,666
1990	27,644	5,050	503	33,197	2,563	35,760
1991	9,480	3,536	316	13,332	2,100	15,432
1992	17,197	2,545	656	20,398	3,856	24,254
1993	15,784	2,726	1,006	19,516	4,670	24,186
1994	8,564	3,000	751	12,315	7,386	19,701
1995	38,584	2,715	739	42,038	6,575	48,613
1996	14,165	3,164	689	18,018	6,107	24,125
1997	35,510	2,800	1,616	39,926	7,990	47,916
1960-1997 Average	15,526	2,661	893	19,079	6,834	25,913
Percent	81%	14%	5%			
1993 to 1997 Avg.	22,521	2,881	960	26,363	6,546	32,908
Percent	85%	11%	4%			
1998 <sup>d</sup>	23,158	4,041	1,576	28,775	NA <sup>d</sup>	NA <sup>d</sup>
Percent	80%	14%	5%			

<sup>a</sup> Unexpanded observed count made from fixed-wing aircraft between 20 July to 5 August.

<sup>b</sup> Considered a minimum number since escapement estimates are unexpanded.

<sup>c</sup> 1998 commercial , subsistence and sport harvests are preliminary.

<sup>d</sup> NA = No escapement index or estimate possible in 1998; hence no total run estimate. 1998 sport harvest preliminary.



## **1998 Season**

The total 1998 return of chinook salmon to the Kanektok is not known due to lack of escapement estimates (Table 13). Attempts to use a counting tower were unsuccessful as were aerial surveys. Commercial harvests totaled 23,158 chinook which is about average. Sport and subsistence fisheries were above average at 1,576 and 4,041, respectively (Table 13).

## **1999 Outlook**

The 1999 return will be the product of escapements observed in 1992 through 1995. Escapements in years 1992 and 1993 were below desired levels, the 1994 escapement was above desired levels, and no escapement index was conducted in 1995. Based on parental escapements, average or slightly below average returns are expected for age-6 and age-7 fish. Returns of age-4 and age-5 fish are expected to be average or slightly better in 1999. Based on parental escapement it is not likely that the sport fishery will be restricted in 1999. Performance of the commercial fishery will be assessed to determine run strength, as will the performance of the subsistence and sport fisheries. If adjustments to the sport fishery are warranted, we will attempt to implement them early enough such that continued sport fishing opportunity will be preserved throughout the season, albeit at a reduced level.

A number of agencies are working with the native village of Quinhagak in an attempt to construct and operate a floating weir on the Kanektok River. We anticipate that the weir will be built in the lower 15 miles of the river.

## **TOGIAC RIVER**

### **Fishery Description**

The Togiak River (Figure 9) is one of three major river systems within the Togiak National Wildlife Refuge. The relatively small chinook salmon sport fishery on the Togiak River is concentrated along the lower 15 miles of the river and runs from mid-June through the month of July. The Togiak River historically supported the second largest chinook salmon run in Bristol Bay, but its remote location, refuge regulations on guides, recent declines in run strength, and a controversy between user groups have limited development of the fishery.

### **Historical Performance**

Commercial harvests of Togiak River chinook salmon have averaged 18,715 fish for the period 1969 to 1997, but in the recent 5 years have averaged only 8,932 (Table 14). Subsistence harvests have remained relatively stable, averaging 624 fish since 1974, and 655 fish in the recent 5 years (Table 14). Sport harvest of Togiak River chinook salmon was estimated to be less than 100 fish per year until the early 1980s, then ranged as high as 925 chinook salmon in 1985. During 1993 through 1997, sport harvests have averaged 607 fish (Table 14). Distribution of the harvest between user groups has remained relatively stable over the history of the fishery. Commercial harvests account for 88%, subsistence and sport harvests both account for about 6% of the total harvest. Total run estimates were first made in 1980, coincident with high abundance of western Alaska chinook salmon stocks. Total run declined from the mid-1980s, dropping to almost half that previously observed. Given the performance of other chinook salmon fisheries in the area, this was likely a shift to more normal levels of production. In the recent 5 years, total runs have averaged 21,499 fish (Table 14).

**Table 14.-Escapement and commercial, subsistence, and sport harvests of chinook salmon from the Togiak River, 1969-1998.**

Year	Harvest				Escapement <sup>b</sup>	Total Run
	Commercial <sup>a</sup>	Subsistence	Sport	Total		
1969	20,092					
1970	28,618					
1971	26,105					
1972	17,099					
1973	9,225					
1974	9,284	1,200				
1975	7,206	800				
1976	28,513	500				
1977	33,827	400	62	34,289		
1978	53,460	300	35	53,795		
1979	27,744	200	78	28,022		
1980	10,858	900	34	11,792	8,045	19,837
1981	22,744	400			12,435	
1982	33,607	400	231	34,238	6,800	41,038
1983	35,669	700	535	36,904	10,975	47,879
1984	19,958	600	46	20,604	19,085	39,689
1985	33,110	600	925	34,635	12,010	46,645
1986	16,267	700	618	17,585		
1987	14,555	700	338	15,593	7,170	22,763
1988	13,205	429			6,390	
1989	9,049	551	234	9,834	6,640	16,474
1990	9,651	480	445	10,576	6,473	17,049
1991	6,472	470	284	7,226	8,380	15,606
1992	11,764	1,361	271	13,396	7,410	20,806
1993	10,769	784	225	11,778	10,210	21,988
1994	9,492	904	663	11,059	15,117	26,176
1995	10,736	448	581	11,765	12,600	24,365
1996	8,281	471	402	9,154	8,299	17,453
1997	5,381	667	1,163	7,211	10,300	17,511
All Years Avg.	18,715	624	377	19,716	9,902	29,618
Percent	95%	3%	2%			
1993 to 1997 Avg.	8,932	655	607	10,193	11,305	21,499
Percent	88%	6%	6%			
1998 <sup>c</sup>	12,878	782	845	14,505	9,856	24,361
Percent	89%	5%	6%			

<sup>a</sup> Commercial harvests from Togiak Section of Togiak District.

<sup>b</sup> Estimated by aerial survey and expanded for missed fish. Biological Escapement Goal is 10,000 fish.

<sup>c</sup> 1998 data are preliminary and subject to revision.

## **Management**

Sport harvest and effort are estimated through the statewide harvest survey and reported by Mills (1979-1994) and Howe et al. (1995-1999). Commercial and subsistence harvests are monitored by the Commercial Fisheries Division and are reported in their Annual Management Report series (ADF&G 1998a, 1999a). Sport Fish Division has conducted significant monitoring and stock assessment projects in the recent past (Minard and Lisac 1984, Dunaway 1990b).

Escapement of chinook salmon into the Togiak River has been estimated by aerial survey from fixed-wing aircraft since 1980. Aerial counts are expanded to account for missed fish and therefore represent total escapement estimates. The escapement goal for Togiak chinook salmon, established in 1984, is 10,000. From 1987 to 1992, department managers failed to manage harvests to achieve the escapement goal (Table 14). Since 1992, the goal has been achieved 4 out of 6 years, and very nearly met in 1998. Escapements from 1993 through 1997 averaged 11,305 fish. Reduced commercial fishing time during the last half of June is primarily responsible for the improved escapement levels. Since 1992, commercial fishing time has been reduced from 5 days per week to 1 or 2 days per week. Based upon the balance between commercial harvest and escapement, it appears this new schedule is sustainable, while the previous one was not.

## **Management Objectives**

The Togiak River chinook salmon sport fishery is managed to achieve a biological escapement goal (BEG) of 10,000 chinook salmon. The annual escapement is estimated by expanded aerial survey counts.

## **1998 Season**

From 1993 through 1997, the total return of chinook salmon averaged 21,499 fish and the 1998 return was expected to be similar or a little better.

The commercial fishery was managed similarly to recent years with reductions from the “normal” weekly schedule of 96 hours. Only 24 hours were allowed in mid June, and 48 hours per week in each of the last two weeks of June. The peak of the run appears to have occurred in early July, which is later than normal. This late timing may have made more of the chinook salmon run vulnerable to incidental harvest during the commercial sockeye salmon fishery. The total commercial harvest was 12,878 chinook salmon, above the recent 5-year average (Table 14).

The subsistence harvest was 782 chinook salmon, also above the recent 5-year average.

The Alaska Board of Fisheries adopted several regulation changes that affected the Togiak chinook salmon sport fishery in 1998. The May 1 through July 31 chinook salmon sport fishery season was established by the Board of Fisheries during the winter of 1997/1998. The season is closed the remainder of the year to protect spawning fish. The same Board meeting resulted in an annual limit of 5 chinook salmon for sport anglers throughout Bristol Bay waters. Anglers are now required to immediately record location and date of each chinook salmon harvested. In addition, guides are no longer allowed to harvest fish while guiding. These measures were designed to moderate the short harvest throughout the Bristol Bay drainage and to spread the harvest among more anglers.

Despite the new restrictions to the sport fishery, the total 1998 sport harvest was 845 chinook salmon (Table 14). The increased harvest is likely due to increased guides on the lower Togiak River, and the above average return realized in 1998. A strong chinook salmon run in the nearby Nushagak River may have brought more effort to the area. The 4 chinook salmon annual limit in the Nushagak drainage, and above average run in both the Nushagak and Togiak rivers may have encouraged some anglers to visit the Togiak River to fill out their 5 fish Bristol Bay limit.

Aerial surveys estimated 9,856 chinook salmon escaped to spawn (Table 14). This is very near the 10,000 fish biological escapement goal.

### **1999 Outlook**

From 1993 through 1998, the total return of chinook salmon averaged 21,564 fish, and the 1999 return is expected to be similar. Escapements for three of the major parent years were at or above the 10,000 fish biological escapement goal. Based on the parental escapements (1992-1995), the 7-year-old fish are expected to be below average, while the age-4, -5, and -6 components are expected to be average or above. Sport opportunity should be good; but the bulk of the catch will consist of modest-sized chinook salmon. Management of the commercial fishery is expected to include a restricted fishing schedule during the last half of June. This action is intended to provide a balance between commercial harvest opportunity and escapement. The sport fishery will commence under the published regulations, and as in the past, performance in the commercial, subsistence, and sport fisheries as well as aerial surveys will be used to gauge run strength inseason. Inseason changes to the sport regulations are not anticipated at this time.

The recreational chinook salmon fishery is open from May 1 through July 31. Bristol Bay annual harvest limits of 5 chinook salmon and recording requirements continue to be in effect.

### **NORTHWESTERN CHINOOK SALMON FISHERIES**

The Kuskokwim River and its tributaries host large runs of chinook salmon, but the broad muddy waters of the main river and limited access to the tributaries within the management area attract a very small but growing number of sport anglers. No estimates of sport harvest are available before 1983, and since 1984 most of the chinook salmon harvest has come from the Aniak River. In recent years, roughly 2% to 5% of the SWMA chinook salmon harvest has come from the Northwestern section.

The total run size for Kuskokwim drainage chinook salmon is not known. Escapements into some of the major tributaries are estimated by aerial surveys. A small but growing number of weirs are being operated throughout the drainage to assess salmon escapement. For now, total harvests are one of the few statistics available for this drainage. From 1989 through 1998, the Kuskokwim River (Districts W1 and W2) commercial harvest (an incidental fishery since 1987) averaged 27,328 chinook salmon per year, subsistence harvests averaged 84,137 fish per year (Burkey et al. 1999a). Recent commercial harvests have been quite variable ranging from about 7,000 fish to as high as 54,000 chinook salmon in a season. By comparison, sport harvests for 1989 through 1997 averaged 680 chinook salmon annually, but exceeded 1,100 fish per year in 1996 and 1997 (Table 7).

In response to conservation concerns, bag limits for Kuskokwim River chinook salmon were reduced from 5 per day and in possession, no size limit to 1 per day and in possession, no size limit in 1988. By 1994 it was apparent that chinook stocks had recovered sufficiently to allow

normal subsistence and above average commercial fisheries to occur, therefore staff recommended to the Board of Fisheries that the bag and possession limits for these waters be returned to 3 per day and in possession of which only 2 may be greater than 28 inches in length. In November of 1994, the Board adopted those recommended changes to the sport fishery, which became effective in 1995.

Since 1995, sport fishing activity in this section has grown, particularly in the vicinity of Aniak. Growth is also apparent on the Kwethluk, Kisaralik, and Kasigluk rivers. The increased pressure has resulted in calls for more restrictions in the sport fishery to avoid conflicts with the commercial and subsistence fisheries.

During the winter of 1997, the Board of Fisheries established a May 1 through July 25 open season for the recreational chinook salmon fishery in this section. The intent was to protect spawning salmon in the fall. Some gear restrictions were adopted for some Kuskokwim tributaries, and though largely addressing resident species issues, chinook salmon anglers were also affected.

The 1998 return of Kuskokwim River chinook salmon was below the recent 10-year average. The commercial take was 17,359 chinook salmon, the lowest harvest since 1963, due largely to restrictions designed to protect chum salmon. The 1998 subsistence take was 81,265 chinook salmon, slightly below the recent 10-year average. The run strength was sufficient that no inseason restrictions were necessary for the sport fishery. Anglers took 1,657 chinook salmon, the biggest sport harvest estimated for this section.

### **1999 Outlook**

Based upon parent year escapement estimates, the 1999 chinook salmon run is expected to be about average. Increasing escapements were observed during the 1992 to 1995 seasons and should result in good returns of age-4 to age-6 fish. However, the 1998 returns from these parent years were average at best. Larger, age-7 fish are likely to be less abundant. The Kuskokwim River chinook salmon season for sport anglers is restricted to the period May 1 through July 25 from the Holitna River drainage downstream, and all drainages entering the southeastern side of Kuskokwim Bay. Sport gear restrictions apply to all or portions of the Aniak, Kisaralik, Kasigluk, and Kwethluk rivers.

## SECTION IV: COHO SALMON FISHERIES

Coho salmon is a very popular sport fish species to Southwest Alaska's recreational fishing industry. Coho salmon fisheries occur from August through September with some isolated pockets of fish available into October. Significant fisheries occur in the Naknek, Alagnak, Nushagak, Mulchatna, Togiak, and Kanektok rivers as well as a host of smaller, less known waters (Figure 10). Over the last 10 years, commercial fisherman have taken the greatest share of the southwest Alaska coho harvest at 93%, followed by 6% harvested by subsistence users and 1% by sport anglers. The Kuskokwim commercial fishery dominates the harvest of this species.

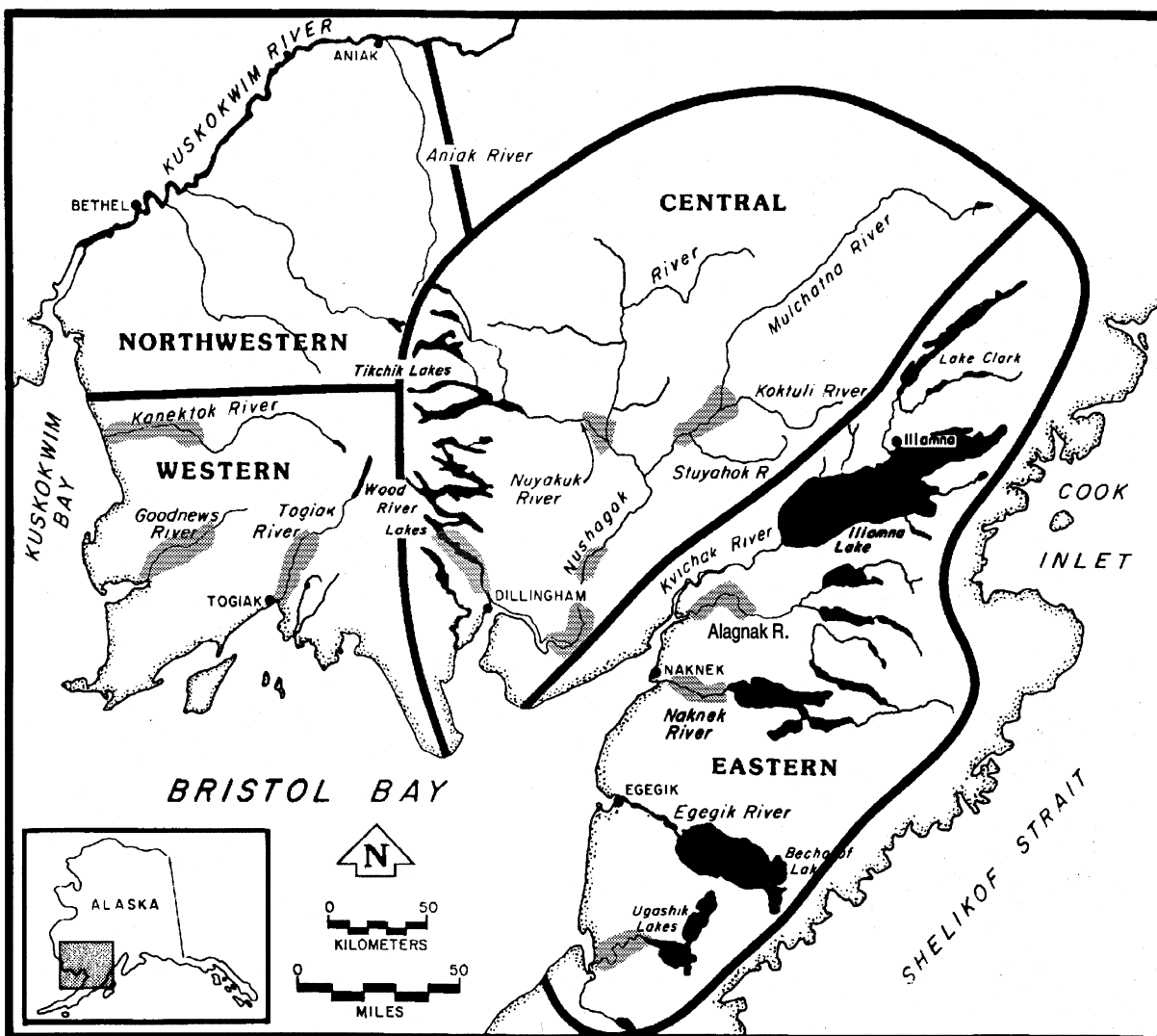


Figure 10.-Popular coho salmon sport fisheries in Southwest Alaska.

During the last 5 years, coho salmon have accounted for approximately 25% of all the salmon harvested by sport fishermen in the SWMA. Harvest increased along with sport fishing effort from 1977 to 1989, from fewer than 1,000 fish to almost 19,000 fish (Figure 11). From 1993 through 1997, the average harvest was 11,684 fish areawide (Table 15). In 1997, anglers harvested 13,900 coho salmon.

Many SWMA anglers pursue coho salmon with the assistance of a guide. Annual estimates of harvest (Howe et al. 1998) indicate that despite the more liberal 5 fish daily bag limit, coho salmon are harvested in approximately the same total numbers as chinook salmon. The mail survey (Howe et al. 1998) also indicates that considerable numbers of coho salmon are caught and released.

Except for the Kvichak River drainage where the daily limit is 2 coho per day and the Alagnak River drainage where the limit is 3 per day, the daily limits for coho salmon are 5 salmon per day, no size limit. The 5 per day limit has been in effect since 1972. The lower limits for the Kvichak and Alagnak drainages were adopted during the 1997 Board of Fisheries meetings (first effective in the 1998 season) to protect the small runs in the Kvichak system and to address modest runs and the large angling effort on the Alagnak River. Some coho salmon returns, particularly in the Central and Western sections, have become very erratic in recent years, precipitating occasional closures or reductions in bag limits for the sport anglers. Except for rare instances, however, limitations on sportsmen have been of little consequence to the strength of the runs that are more heavily impacted by commercial harvests. The lack of escapement data on which to judge the health of the stocks, or base reasonable escapement and harvest goals for all segments of the coho salmon fishery, has become a major concern. The declines observed in some of the area's runs may be the result of excessive harvests in previous years.

## **NAKNEK RIVER**

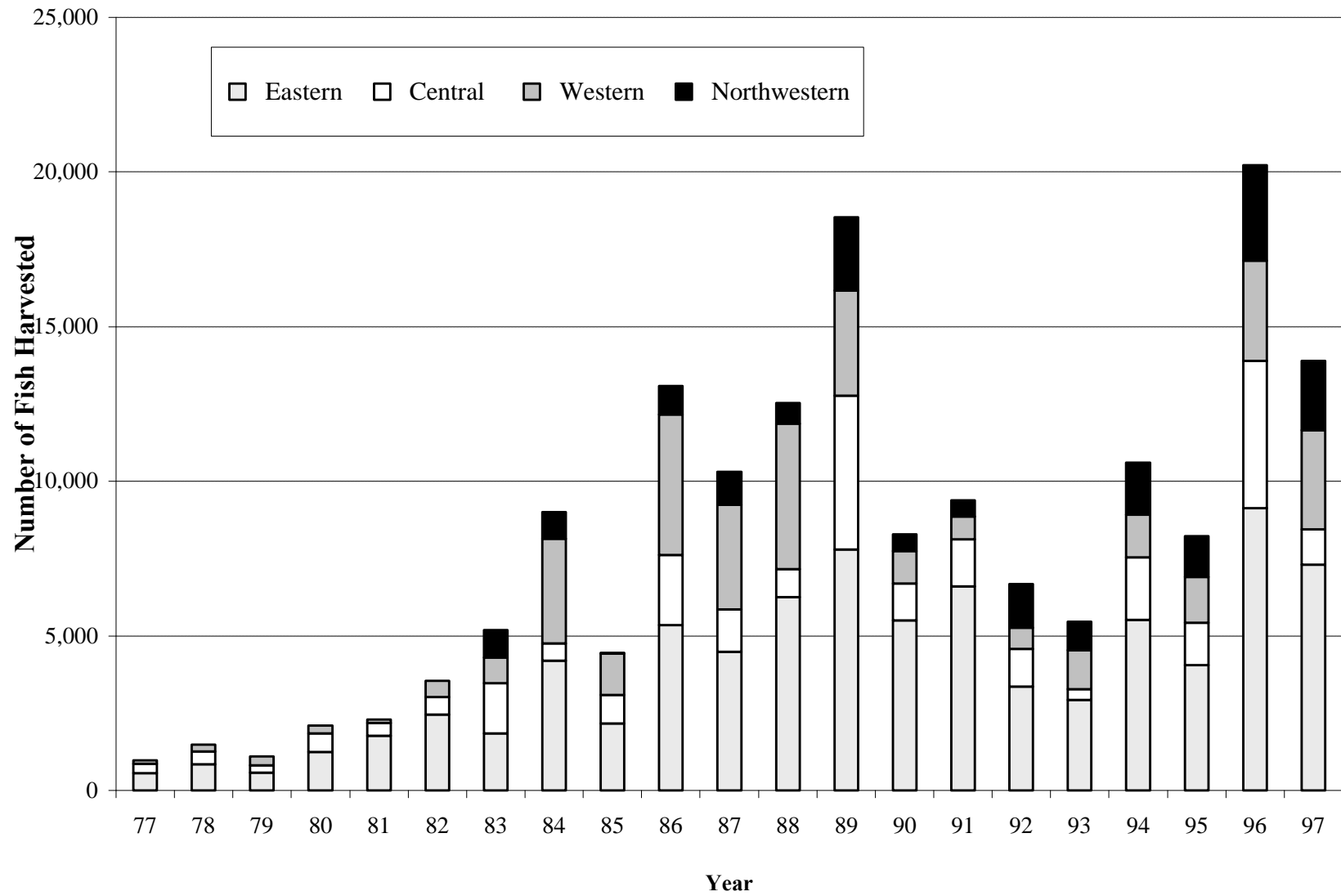
### **Fishery Description**

In the Naknek River, the coho salmon sport fishery develops in late July and continues well into September. The peak period is normally from August 7 to August 21. Effort is concentrated along a 12-mile stretch of the Naknek River adjacent to the community of King Salmon; but significant and possibly increasing effort occurs upstream from Rapids Camp to Lake Camp. This fishery is the most popular coho salmon fishery in the area and provides significant recreational opportunity and economic benefit for the community of King Salmon.

### **Historical Performance**

Harvests of coho salmon by the recreational fishery averaged 2,528 fish during 1993-1997, and accounted for 21% to 61% of the total harvest of Naknek River coho salmon (Table 16). Total annual harvest of coho from the Naknek River increased significantly in 1988, and remained high through 1991. Since 1992 annual harvests have ranged rather widely from barely 1,000 coho salmon in 1993 to nearly 5,000 in the unusually good season of 1996 (Table 16). The decline in total harvest for this run is attributed to reduced run size and slightly more conservative management in the commercial fishery. The sport fishery has the potential to grow as a result of the construction of several new lodges in the King Salmon area.

In the past, a local commercial fishing venture, the Fall Fishing Cooperative, arranged to provide markets for salmon after the normal sockeye season, resulting in substantial increases in



**Figure 11.-Sport harvest of coho salmon by section from the Southwest Alaska Management area, 1977 to 1997.**



**Table 15.-Sport harvest of coho salmon from the waters of Southwest Alaska by fishery, 1977-1997.**

Drainage	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Eastern											
Ugashik	26	163	125	17	87	314	157	611	0 <sup>a</sup>	31 <sup>a</sup>	215
Egegik/Becharof	138	0	0	155	65	10	115	312 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>
Naknek R.	297	646	300	818	1,156	1,676	1,385	2,332	1,281	1,942	2,187 <sup>b</sup>
Naknek L.	0	0	0	0	0	0	0	0	0 <sup>a</sup>	92	0
Bay of Islands							0	0	37	153 <sup>a</sup>	0
Brooks R.	0	0	0	0	0	0	0	62	37	46	215
Brooks L.											
American Cr.							0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	107 <sup>a</sup>
King Salmon R.											
Kvichak R.	86	38	150	258	65	42	42	100	0	850	0
Copper R.	0	0	0	0	0	0	0	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>
Alagnak R.					400	422	147	599	11	1,699	46
Newhalen R.	0	0	0	0	0	0	0	50	404	238	687
L Talarik Cr.	5	0	0	0	0	0	0	75 <sup>a</sup>	0	0 <sup>a</sup>	0 <sup>a</sup>
Lake Clark	0	0	0	0	0	0	0	0	11	0	0
Lake Iliamna							0 <sup>a</sup>	0 <sup>a</sup>	212 <sup>a</sup>	204	962
Kulik R.											
Tazimina R.											
Moraine Cr.											
Other							0	49	181	91	64
Subtotal	552	847	575	1,248	1,773	2,464	1,846	4,190	2,174	5,346	4,483

-continued-

**Table 15.-Page 2 of 4.**

Drainage	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	5-Year Average
Eastern											
Ugashik	186 <sup>a</sup>	234	840	97	445	92	739	346	451	651	456
Egegik/Becharof	217 <sup>a</sup>	104	300	97	275	48	426	48	536	411	294
Naknek R.	4,065 <sup>b</sup>	4,801 <sup>b</sup>	2,179	4,475	1,579	1,034	1,940	1,788	4,964	2,912	2,528
Naknek L.	217 <sup>a</sup>	78	0	32	73	0	0	68	0	0	14
Bay of Islands	0 <sup>a</sup>	26	0	11	32	19	0	0	0	11	6
Brooks R.	0	52	200	65	24	36	10	141	20	174	76
Brooks L.			420	0	0	10	0	39	40	23	22
American Cr.	0 <sup>a</sup>	26	0	0 <sup>a</sup>	0	0	0	0	0	0	0
King Salmon R.					24	38	0	0 <sup>a</sup>	268 <sup>a</sup>	0 <sup>a</sup>	61
Kvichak R.	31	227	444	329	162	370	553	213	338	597	414
Copper R.	0 <sup>a</sup>	0	0	0	0	0	0	0	0	0	0
Alagnak R.	588 <sup>a</sup>	403	194	602	324	246	763	331	1,902	876	824
Newhalen R.	248	1,160	467	261	81	444	484	394	20	450	358
L Talarik Cr.	93 <sup>a</sup>	0 <sup>a</sup>	0	0	0	19	9	19	0	33	16
Lake Clark	0 <sup>a</sup>	0	0	102	32	120	0	76	0	121	63
Lake Iliamna	62	302	57	114	0	93	54	206	0	112	93
Kulik R.					0	0	0	0	0	0	0
Tazimina R.					0	0	0	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0
Moraine Cr.					0	0	0	0	0	0	0
Other	558	390	400	424	316	363	535	379	599	932	562
Subtotal	6,265	7,803	5,501	6,609	3,367	2,932	5,513	4,048	9,138	7,303	5,787

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**Table 15.-Page 3 of 4.**

Drainage	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Central											
Nushagak	65	126	212	379	216	451	849	399	0	934	595
Mulchatna	90	113	0	129	173	52	524	37	130	496	0
Agulowak											
Agulukpak											
Wood River L.	61	25	25	43	22	52	126	100	781	701	366
Tikchik/Nuyakuk	93	151	0	43	0	0	31	0	0	0 <sup>a</sup>	366 <sup>a</sup>
Koktuli R.											
Other					0	0	94	37	0	146	46
Subtotal	309	415	237	594	411	555	1,624	573	911	2,277	1,373
Western											
Togiak	114	214	300	258	119	524	294	1,295 <sup>b</sup>	342 <sup>b</sup>	2,851	409 <sup>b</sup>
Goodnews							168	195 <sup>a</sup>	386	0 <sup>a</sup>	685 <sup>a</sup>
Kanektok							367	1,895	622	1,680 <sup>b</sup>	2,300
Arolik											
Other							0	0	0	0	
Subtotal	114	214	300	258	119	524	829	3,385	1,350	4,531	3,394
Northwestern											
Aniak							42 <sup>a</sup>	<sup>a</sup>	12 <sup>a</sup>	905 <sup>a</sup>	254 <sup>a</sup>
Kisaralik											
Kwethluk											
Other							850	857	12	24	815
Subtotal							892	857	24	929	1,069
Eastern	552	847	575	1,248	1,773	2,464	1,846	4,190	2,174	5,346	4,483
Central	309	415	237	594	411	555	1,624	573	911	2,277	1,373
Western	114	214	300	258	119	524	829	3,385	1,350	4,531	3,394
Northwestern							892	857	24	929	1,069
Total	975	1,476	1,112	2,100	2,303	3,543	5,191	9,005	4,459	13,083	10,319

-continued-

**Table 15.-Page 4 of 4.**

Drainage	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	5-Year Average
<b>Central</b>											
Nushagak	124	1,586	331	415	445	124	845	521	2,333	225	810
Mulchatna	371	364	95	437	275	53	230	204	496	124	221
Agulowak										99 <sup>a</sup>	99
Agulukpak										0 <sup>a</sup>	0
Wood River L.	341	2,417	131	394	275	100	820	450	307	430	421
Tikchik/Nuyakuk	31	442	12	22	32	17	50	0	824	87	196
Koktuli R.					0	0	18	0 <sup>a</sup>	60	0 <sup>a</sup>	16
Other	31	156	622	241	185	57	75	196	730	181	248
Subtotal	898	4,965	1,191	1,509	1,212	351	2,038	1,371	4,750	1,146	1,931
<b>Western</b>											
Togiak	1,238 <sup>a</sup>	1,976 <sup>b</sup>	367	87	251	330	531	408	1,400	746	683
Goodnews	0 <sup>a</sup>	224	36 <sup>a</sup>	297	138	189	170	114	466	980	384
Kanektok	1,837	1,096	644	358	275	734	675	970	1,251	1,220	970
Arolik										249 <sup>a</sup>	249
Other	1,637	112	0	0	16	0	0	0	119	0	24
Subtotal	4,712	3,408	1,047	742	680	1,253	1,376	1,492	3,236	3,195	2,110
<b>Northwestern</b>											
Aniak	618 <sup>a</sup>	939	182	327	235	213	507	852	986	863	684
Kisaralik							72	0 <sup>a</sup>	636 <sup>a</sup>	205 <sup>a</sup>	228
Kwethluk					624	313	525 <sup>a</sup>	0 <sup>a</sup>	656 <sup>a</sup>	299 <sup>a</sup>	359
Other	36	1,420	363	195	558	399	577	466	818	889	630
Subtotal	654	2,359	545	522	1,417	925	1,681	1,318	3,096	2,256	1,855
<b>Summary</b>											
Eastern	6,265	7,803	5,501	6,609	3,367	2,932	5,513	4,048	9,138	7,303	5,787
Central	898	4,965	1,191	1,509	1,212	351	2,038	1,371	4,750	1,146	1,931
Western	4,712	3,408	1,047	742	680	1,253	1,376	1,492	3,236	3,195	2,110
Northwestern	654	2,359	545	522	1,417	925	1,681	1,318	3,096	2,256	1,855
Total	12,529	18,535	8,284	9,382	6,676	5,461	10,608	8,229	20,220	13,900	11,684

Source: Mills 1977-1994, Howe et al. 1995-1998. Unless otherwise noted, these are published estimates for sites that garnered 12 or more responses in the Statewide Harvest Survey.

<sup>a</sup> Unpublished estimates from Statewide Harvest Survey for sites with less than 12 responses.

<sup>b</sup> Estimates from onsite creel survey.

**Table 16.-Coho salmon commercial, subsistence, and sport harvest from the Naknek River, 1971 to 1998.**

Year	Harvest			
	Commercial <sup>a</sup>	Subsistence <sup>b</sup>	Sport	Total
1971	89	100		
1972	402	100		
1973	255	500		
1974	916	200		
1975	43	200		
1976	1,195	600		
1977	2,883	300	297	3,480
1978	913	300	646	1,859
1979	12,355	1,200	300	13,855
1980	7,802	800	818	9,420
1981	1,229	1,100	1,156	3,485
1982	10,586	1,000	1,676	13,262
1983	7,282	900	1,385	9,567
1984	3,209	600	2,332	6,141
1985	10,474	1,103	1,281	12,858
1986	5,824	650	1,942	8,416
1987	5,274	1,044	2,292	8,610
1988	29,988	823	4,065	34,876
1989	22,668	1,927	4,801	29,396
1990	16,091	726	2,179	18,996
1991	17,527	1,056	4,475	23,058
1992	18,553	831	1,579	20,963
1993	1,779	1,572	1,034	4,385
1994	5,877	1,311	1,940	9,128
1995	981	1,013	1,788	3,782
1996	3,816	1,482	4,964	10,262
1997	678	1,200	2,912	4,790
<hr/>				
All Years Avg.	6,988	838	2,089	9,915
Percent	70%	8%	21%	
<hr/>				
1993 to 1997 Avg.	2,626	1,316	2,528	6,469
Percent	41%	20%	39%	
<hr/>				
1998 <sup>c</sup>	1,550	1,592	2,800	5,942
Percent	26%	27%	47%	

<sup>a</sup> Commercial harvests are for the Naknek Kvichak district and therefore include stocks destined for the Kvichak, Alagnak, and Naknek rivers.

<sup>b</sup> Previous tables may have presented rounded estimates; this table presents actual raw counts from returned permits, 1975 to 1996. 1970-1986 data based on permits issued in King Salmon, Naknek, South Naknek; 1987-1998 data based on Naknek watershed fishing sites as indicated on permit.

<sup>c</sup> 1998 preliminary estimates.

commercial effort in August and September. Lately, the fall commercial fishery has not been active due to poor markets and its impact on coho salmon has been modest. Most of the 1998 commercial take was incidental to the sockeye salmon fishery. Subsistence harvests of coho salmon appear stable in the recent past averaging 1,316 fish per year, and account for about 20% of the harvest (Table 16).

## **Management**

Sport harvest and effort are estimated through the statewide harvest survey and reported by Mills (1979-1994) and Howe et al. (1995-1999). Commercial and subsistence harvests are monitored by the Commercial Fisheries Division and are reported in their Annual Management Report series (ADF&G 1998a, 1999a). Sport Fish Division has conducted significant monitoring and stock assessment projects in the recent past (Minard and Brookover 1988a, Minard 1989a, Coggins 1992, Dunaway and Fleischman 1996a).

No biological escapement goal (BEG) has been established for Naknek River coho salmon stocks. In 1997 some aerial surveys were flown to assess coho salmon escapement in the Naknek drainage. Because of the lack of escapement information it is impossible to assess fishery impacts on the total run.

The present bag and possession limits for coho salmon on the Naknek River are 5 fish per day, no size limit; the same limit has been in effect since 1972. No adjustments to the Naknek River coho salmon fishery bag and possession limits have ever occurred by inseason emergency order.

Management concerns for this fishery center on the lack of escapement data, the department's inability to assess fishery impacts, and the lack of a management goal or target for this growing fishery. Without a clearer management target, justification for adjusting fishing time in the various fisheries is tenuous.

## **Management Objectives**

No explicit management objectives exist for this fishery.

## **1998 Season**

The estimated 1998 harvest of 5,942 fish by all user groups is approximately 92% of the average of the recent 5-year period (Table 16). The sport fishery accounted for 2,800 fish. Harvests in the commercial and subsistence were nearly identical at 1,550 and 1,592 coho salmon, respectively (Table 16). The small commercial harvest was a function of low market demand and little effort.

## **1999 Outlook**

The lack of stock assessment data makes it difficult to generate a forecast for the 1999 coho salmon return to the Naknek River. The subsistence and sport harvests from 1995, the major parent year for the 1999 return, were average or a little less. However the commercial harvest was extremely low and it is believed the parent year run was well below average. While coho returns are highly erratic, and strong returns from poor parent years are not uncommon, the department will approach the 1999 Naknek and Alagnak River coho season with expectations of a below average run. Inseason fishery restrictions may be necessary in 1999. If restrictions become necessary, the department will attempt to preserve some angling and harvest opportunity throughout the season. The Naknek River upstream from the ADF&G marker at Rapids Camp has been restricted to single hooks with a point-to-shank gap of 1/4 inch or less until August 1.

## **NUSHAGAK AND MULCHATNA RIVERS**

### **Fishery Description**

The Nushagak and Mulchatna rivers produce the largest return of coho salmon in Bristol Bay. Within the drainage there are four areas of concentrated recreational effort: the lower 12 miles of the Nushagak River near the village of Portage Creek, the middle section of the Nushagak River in the vicinity of the village of Ekwok, the mid section of the Mulchatna River between the Stuyahok and Koktuli rivers, and the Nuyakuk River at its confluence with the Nushagak River (Figure 10). Although sport fishing for coho salmon occurs in some of the tributaries of the drainage, the overall harvest resulting from that activity is considered slight. Of the areas mentioned above, the lower portion of the Nushagak River and the mouth of the Nuyakuk River are the most significant. The lower Nushagak River provides fishing opportunity for early coho salmon in late July and early August when other fisheries have not yet begun.

### **Historical Performance**

The sport harvest has averaged 1,242 fish, or about 9% of the total harvest of Nushagak and Mulchatna coho stocks from 1993 through 1997 (Table 17). Commercial harvest accounted for 59%, and subsistence 32%, of the total harvest for the same period. With the adoption of the Nushagak Coho Management Plan and frequent poor runs, the recent commercial harvest has declined. Subsistence harvest has tended to increase since such harvests were first recorded. At these levels, the coho salmon sport fishery is considered to have a minor impact on the overall productivity of Nushagak and Mulchatna drainage coho stocks.

The Nushagak coho salmon stocks are considered to be depressed but in stable condition. A chronic inability to hit escapement targets despite significant management actions in recent years supports this assessment of stock status. Only 4 of the 11 years since 1988 have achieved the 90,000 fish escapement goal. Significant restrictions have been placed on all fisheries, including closure of the subsistence fishery, to reduce exploitation on this stock.

### **Management**

Sport harvest and effort is estimated through the statewide harvest survey and reported by Mills (1979-1994) and Howe et al. (1995-1999). Commercial and subsistence harvests are monitored by the Commercial Fisheries Division and are reported in their Annual Management Report series (ADF&G 1998a, 1999a). Inriver abundance of coho salmon in the Nushagak is estimated by side scan sonar operated near the village of Portage Creek. Sport and subsistence harvests are assumed to occur above the sonar site; therefore, estimated spawning escapement is equal to the sonar count minus sport and subsistence harvest.

From 1984 to 1992, Nushagak coho salmon stocks were managed to achieve a biological escapement (BEG) of 150,000 fish, estimated by sonar at Portage Creek. However, spawning escapements during that period consistently fell short of the goal, averaging 80,897 fish (Table 17). Subsequent spawner-recruit analysis suggested the 150,000 fish goal was higher than necessary to manage for maximum sustained yield. The department used the new spawner-recruit data to reduce the BEG to 90,000 spawners in 1992 (ADF&G 1992). To achieve 90,000 spawners necessitated managing the commercial fishery to achieve an inriver abundance of

**Table 17.-Coho salmon commercial, subsistence, and sport harvest plus escapement for the Nushagak drainage, 1972 to 1998.**

Year	Harvest					Total	Spawning Escapement <sup>e</sup>	Total Run
	Commercial <sup>a</sup>	Subsistence <sup>b</sup>	Nush <sup>c</sup>	Mul <sup>d</sup>	Sport Total			
1972	3,654	1,000				4,654		
1973	28,709	2,200				30,909		
1974	12,569	4,700				17,269		
1975	7,342	4,300				11,642		
1976	6,778	2,100				8,878		
1977	52,562	4,500	158	90	248	57,310		
1978	44,740	2,502	403	113	516	47,758		
1979	129,607	5,156	212	0	212	134,975		
1980	146,354	4,099	422	129	551	151,004	95,368 <sup>f</sup>	246,372
1981	219,310	7,930	216	173	389	227,629	141,468 <sup>f</sup>	369,097
1982	345,903	8,044	451	52	503	354,450	294,151	648,601
1983	66,109	4,880	927	571	1,498	72,487	36,885	109,372
1984	257,649	7,449	418	55	473	265,571	140,804	406,375
1985	20,230	6,006	0	130	130	26,366	82,258	108,624
1986	68,568	9,150	1,007	569	1,576	79,294	45,483	124,777
1987	13,263	5,358	984	23	1,007	19,628	21,268	40,896
1988	53,125	4,627	171	386	557	58,309	130,171	188,480
1989	77,073	8,130	2,028	364	2,392	87,595	81,107 <sup>f</sup>	168,702
1990	7,447	5,622	343	95	438	13,507	140,500	154,007
1991	5,399	10,190	437	437	874	16,463	37,584	54,047
1992	84,898	6,496	477	275	752	92,146	NA	NA
1993	14,244	4,850	141	53	194	19,288	42,161	61,449
1994	6,814	4,632	895	248	1,143	12,589	80,425	93,014
1995	4,181	3,905	521	204	725	8,811	45,269	54,080
1996	12,477	5,217	3,157	556	3,713	21,407	187,439	208,846
1997 <sup>g</sup>	3,123	3,433	312	124	436	6,992	NA <sup>h</sup>	NA <sup>h</sup>
All Years Avg.	65,082	5,249	651	221	873	71,204	100,146	171,350
Percent	91%	7%			1%			
1993-1997 Avg.	8,168	4,407	1,005	237	1,242	13,817	88,824	102,641
Percent	59%	32%			9%			
1998 <sup>i</sup>	22,127	5,316	1,297	0	1,297	28,740	103,478	132,218
Percent	77%	18%			5%			

<sup>a</sup> Commercial harvests for 1972-1995 represent final numbers based on fish receipts. Numbers for 1996 are preliminary.

<sup>b</sup> Subsistence harvests for **whole** Nushagak drainage, based on permit returns by community of residence including Manokotak. From Bev Cross 12/9/96- includes up river and down river of sonar. ADF&G 1999b.

<sup>c</sup> Nushagak River and tributaries excluding the Wood River and Mulchatna River and tributaries. Estimates of Nushagak drainage (Central Section) coho harvest listed as Other were excluded. To conservatively estimate the number of potential spawners, the entire Nushagak River sport harvest was assumed to have been taken upstream of the Portage Creek sonar.

<sup>d</sup> Mulchatna River and tributaries.

<sup>e</sup> Inriver abundance estimated by sonar counter at Portage Creek minus upriver subsistence and sport harvest.

<sup>f</sup> 1980, 1981, 1989 escapements are estimates based on exploitation rates from the harvest and not on sonar.

<sup>g</sup> 1997 no escapement estimate available, hence no total run estimate possible.

<sup>h</sup> NA = Not available.

<sup>i</sup> 1998 preliminary data.



100,000 fish. The additional 10,000 coho salmon provided for subsistence and sport harvests above the sonar site at Portage Creek.

The present bag and possession limits for coho salmon on the Nushagak and Mulchatna drainage are 5 fish per day, no size limit. That is the same background limit for most of the region, and has been in effect since 1972. The first adjustment to that limit occurred in 1991 when the daily bag and possession limits were reduced from 5 to 2 by emergency order. Since then the limits have been adjusted by emergency order several times in response to stock conservation problems.

### **Management Objectives**

Currently management of Nushagak/Mulchatna River coho salmon is governed by 5 AAC 06.368. Nushagak River Coho Salmon Management Plan adopted by the Alaska Board of Fisheries in December of 1995. The plan calls for managing the commercial fishery for an inriver return of 100,000 which provides for a spawning escapement of 90,000, a reasonable opportunity in the subsistence fishery, and a 2,000 guideline harvest in the sport fishery. The plan goes on to address management actions that should be taken should the inriver return fall short of the goal. In the sport fishery, should the inriver return fall below 60,000, then restrictions to maintain the sport harvest below 2,000 are required. If the inriver return is less than 50,000 then closure of the sport fishery is required. Along with the sport fishery management actions, the plan directs the department when to take actions in the commercial and subsistence fisheries. All fisheries are to close when the inriver return falls below 50,000.

### **1998 Season**

A poor parent year escapement, thought to be about 80,000 fish, caused the department to approach the 1998 season very cautiously. Preseason, the angling public was advised that there was a high likelihood the sport fishery would be restricted, depending upon the inseason escapement estimates. Unprecedented high escapement estimates August 3 and 4 assured the minimum escapement goals would be achieved early in the season. From August 5-16, escapement was often below normal rates and department staff remained concerned and cautious. A surge of fish on August 17 and 18 assured the 100,000 escapement estimate would be achieved. No emergency order restrictions were necessary in the sport fishery. The final spawning escapement estimate was 103,478 coho, and another 22,127 were harvested in the directed commercial fishery (Table 17). In addition to good escapement and commercial harvests, the subsistence harvest exceeded 5,000 coho from throughout the drainage, and the sport fishery harvested 1,297 coho salmon. The total run was much better than expected and is estimated to have been over 132,000 fish.

### **1999 Outlook**

The 1999 coho salmon return to the Nushagak drainage will be primarily the product of the 1995 parental escapement. Escapement in 1995 was approximately 45,269 coho salmon; half the desired spawning escapement and less than half of the desired inriver goal of 100,000 fish. Combined harvest by all user groups was only 8,811 fish. There are insufficient data for a formal forecast. Based on parental run strength we have doubts whether the 1999 return will be sufficient to sustain a normal commercial fishery, and may not sustain a normal sport fishery. The surprisingly strong 1998 return in spite of poor parent year escapement adds more uncertainty to our expectations for 1999. However, uncertainty argues for extreme caution if all user groups are to avoid extended closed periods or severe seasonal limitations on Nushagak

coho salmon. All fisheries will be carefully monitored. Management decisions will be made according to the Nushagak Mulchatna Coho Salmon Management Plan which directs the department to examine inseason harvest information and the escapement assessment at the Portage Creek sonar counter. Inseason restrictions to the sport fishery may be necessary.

## **WOOD RIVER LAKES**

### **Fishery Description**

The Wood River Lakes system is a series of six, large, deepwater lakes connected by short swift rivers within the Wood-Tikchik State Park. Known for a variety of fishery resources including Arctic char/Dolly Varden, rainbow trout, and sockeye salmon, the Wood River system also supports significant coho salmon stocks. The majority of the sport fishing effort directed toward Wood River drainage coho salmon occurs at the confluence of Silver Salmon Creek and Wood River, and the outlets of Ice, Youth, and Sunshine creeks on Lake Aleknagik. Sport fishing effort directed toward coho salmon has grown substantially in recent years and has come primarily from greater numbers of local residents pursuing sport fishing as a leisure activity. A few new lodges based on Lake Aleknagik are contributing additional guided effort on these stocks.

### **Historical Performance**

Harvest data for coho salmon in the Wood River Lake system (Table 15) date back to 1977 (Mills 1979-1994 and Howe et al. 1995-1999). From 1977 through 1984, sport harvest in the drainage never exceeded 200 fish. Since 1985, however, the harvest levels have increased. The recent 5-year average harvest of sport-caught coho salmon is 421 fish (Table 15). This level of harvest is in sharp contrast to the estimated harvest of 2,417 coho salmon reportedly taken in 1989. Estimates of sport harvest noted in the statewide harvest survey are obviously not without error. All things considered, it is safe to say that the coho salmon sport fishery in the Wood River Lake system is growing, probably accounting for about 500 to 1,000 fish annually.

### **Management**

No biological escapement goal (BEG) has been established for coho salmon stocks in the Wood River drainage. There is no escapement assessment program in place or planned for these stocks, making it impossible to assess fishery impacts on total run.

Sport harvests are limited to 5 per day and in possession, with no size limit. Terminal tackle is not restricted in any manner beyond the normal methods and means generally allowed in fresh waters.

Management concerns for this stock focus primarily on the effect commercial and subsistence harvests may be having on Wood River stocks. The driving force behind management is the Nushagak coho salmon escapement. Presumably, a fishing schedule in the commercial fishery that allows achievement of the desired escapement in one system will allow sufficient numbers into the other, but there is no way to measure this. A full stock assessment program is needed to better describe the extent to which Wood River drainage coho stocks are impacted by the commercial fishery, what order of magnitude the escapements are, and to what degree the Nushagak and Wood River stocks are mingled in the commercial district.

### **Management Objectives**

No explicit management objectives exist for this fishery.

## **1998 Season**

No data are available to address the 1998 season other than reports from area residents who indicated "fair numbers" of coho salmon in the Wood River Lakes system this fall.

## **1999 Outlook**

No data are available to make a projection.

## **KANEKTOK RIVER**

### **Fishery Description**

Coho salmon play a major role in the Kanektok River sport fishery and are caught primarily in the lower 12 miles of the river near the village of Quinhagak (Figure 10). The fishery peaks in mid August. Because of its relatively small size, clear water, and consistent returns of coho salmon, the Kanektok River is one of the finest coho salmon sport fisheries in western Alaska.

### **Historical Performance**

The total run of coho salmon in the Kanektok River averages about 80,000 to 90,000 fish annually and produces an average total harvest of roughly 70,000 fish (Table 18). More than 90% of the harvest is typically taken by the commercial fishery which averaged 71,502 coho salmon per year from 1993 through 1997 (Table 18). Recent sport harvests account for 1% to 2% of the total harvest and have not returned to the peak levels observed in 1984 through 1988 (Table 18). After dropping to an all time low in 1992, the annual sport harvest has generally increased to average 970 coho salmon from 1993 through 1997. The subsistence harvest of coho salmon has been relatively stable, averages around 2,000 or more fish per year and accounts for 3% to 4% of the total annual harvest.

### **Management**

Sport harvest and effort are estimated through the annual statewide harvest and participation survey and reported by Mills (1979-1994) and Howe et al. (1995-1999). Commercial and subsistence harvests are monitored by the Bethel office of the Commercial Fisheries Division and reported in the Annual Management Report series (ADF&G 1994, Francisco et al. 1995, Burkey et al. 1997, 1998). Sport Fish Division has conducted significant monitoring and stock assessment projects in the recent past (Alt 1986, Minard 1987c, Dunaway and Bingham 1992b, Dunaway and Fleischman 1995a).

Escapement of coho salmon into the Kanektok River is usually estimated by aerial survey when weather and water conditions permit. Counts, made between August 20 and September 5, are left unexpanded and represent only minimum escapement estimates. Since 1984, the observed escapement of coho salmon into the Kanektok River has ranged from 1,755 to 46,830 (Table 18). No formal escapement goal has been established for Kanektok River coho salmon. Poor weather and water clarity, and lack of funding contribute to the erratic aerial escapement estimates.

In 1996, the Quinhagak Indian Reorganization Act (IRA) Council, Togiak National Wildlife Refuge, and the Arctic-Yukon-Kuskokwim region of Commercial Fisheries Division (CFD), initiated a salmon escapement counting tower project in the lower Kanektok River. The 1996

**Table 18.-Coho salmon commercial, subsistence, and sport harvest plus escapement for the Kanektok River, 1983 to 1998.**

Year	Harvest			Escapement Index <sup>a</sup>	Total Run <sup>b</sup>
	Commercial	Subsistence	Sport		
1983	32,442		367		
1984	132,151		1,895	46,830	180,876
1985	29,992		622		
1986	57,544		2,010		
1987	50,070		2,300	20,056	72,426
1988	68,605	2,933	1,837		
1989	44,607	3,346	1,096	1,755	50,804
1990	26,926	3,510	644		
1991	42,571	2,901	358	4,330	50,160
1992	86,404	2,172	275		
1993	55,817	1,381	734		
1994	83,912	2,282	675		86,869
1995	66,203	2,650	970	2,250	72,073
1996	118,718	1,497	1,251	23,656 <sup>c</sup>	145,122
1997 <sup>c</sup>	32,862	2,000	1,220	23,166 <sup>d</sup>	59,248
All Years Avg. Percent	61,922 95%	2,467 4%	1,084 2%	17,435	82,907
1993 to 1997 Avg. Percent	71,502 96%	1,962 3%	970 1%	16,357	90,792
1998 <sup>e</sup> Percent	80,183 97%	1,702 2%	901 1%	NA <sup>e</sup>	NA

<sup>a</sup> Unexpanded observed count made from fixed-wing aircraft.

<sup>b</sup> Considered a minimum number since escapement estimates are unexpanded.

<sup>c</sup> 1996 escapement survey was partial due to poor conditions.

<sup>d</sup> 1997 escapement estimate is based on tower count ending August 21; aerial survey conditions poor.

<sup>e</sup> 1998 preliminary estimates. No escapement count in 1998.

project closed too early in the coho salmon run to provide useful information (Burkey et al. 1998). In 1997 the tower was operated until August 21 and provided the only estimate of coho salmon escapement for the season. The presence of significant numbers of sockeye salmon during the early coho salmon run has confounded staff's ability to make accurate counts. In 1998, muddy water conditions made it impossible to accurately count salmon. A weir is much

more likely to provide accurate counts and identification of salmon. The results of the tower have been reported by CFD, Bethel (Burkey et al. 1998).

Bag limits for coho salmon were very liberal, allowing 15 fish per day, 30 in possession until 1986. In 1987, the Board recognized the significance of the harvest potential of this fishery and reduced bag and possession limits to 5 fish daily, the standard limit for the area. Interestingly, the bag limit of 5 fish per day is seldom taken by sport fishermen on the Kanektok River. Fishery surveys conducted in 1991 and 1994 found only 7% to 15% of the anglers interviewed left the river with a full limit of 5 fish (Dunaway and Bingham 1992b, Dunaway and Fleischman 1995a). Most interviewed anglers (61% in 1991 and 66% in 1994) elected to take no fish, even though over 95% of them had caught and released at least one fish.

Sport harvests, which appear relatively minor, do not totally reflect the importance of this species to the recreational fishery. In 1986, over 22,500 coho salmon were landed of which only 1,680 (7%) were harvested (Minard 1987c). In 1990, approximately 14% of the coho salmon caught were retained, and since 1992 the retention rate has averaged approximately 25% (Mills 1991-1994, Howe et al. 1995-1998). Hook-and-release mortality has been found to be significant for sport-caught coho salmon, particularly those caught in intertidal areas (Vincent-Lang et al. 1993). The Kanektok River coho salmon sport fishery occurs upstream of the intertidal area, therefore mortality due to hook and release is judged to have a minor impact on the overall health of the stocks. Beginning in 1998, fishing in the entire Kanektok drainage was limited to unbaited single-hook artificial lures.

## **Management Objectives**

No explicit management objectives exist for this fishery.

## **1998 Season**

The 1994 coho salmon return, parent year for the 1998 return, produced average commercial, subsistence, and sport harvests and an average return was expected for the Kanektok River in 1998. As mentioned earlier, water conditions prevented effective use of the salmon counting tower and inseason assessment of the coho salmon run was impossible. Management had to rely on commercial and subsistence catch rates, and other anecdotal information. In addition a department creel survey on the coho salmon sport fishery provided inseason data from August 7 to August 25. Poor weather and water conditions prevented aerial escapement index flights and no total run estimates can be made.

Catches in all fisheries were about average or better, though the run was a little slow to develop. Given the average performance, there was no need for inseason restrictions to the sport fishery. Total sport harvest was 901 coho salmon, the subsistence take was 1,702 fish and the commercial fishery took 80,183 fish (Table 18).

## **1999 Outlook**

The 1995 coho salmon return, parent year for the 1999 return, produced above average commercial, subsistence, and sport harvests. Sport catches of coho salmon (all fish caught, including those released) in the 1995 sport fishery were good according to reports from the sport fishery. The escapement estimates available for the parent year were incomplete. Considering the performance of the 1995 fisheries, and the uncertain parental escapement index, an average coho salmon return is expected for the Kanektok River in 1999. The performance of the

commercial fishery and subsistence fishery will be closely watched to detect any conservation problems as early as possible. A weir for escapement enumeration may be installed in time for the coho salmon run and may provide new inseason insights into run strength. In 1999, staff will be prepared to make inseason changes to fishing regulations as warranted.

Note that sport fishing throughout the Kanektok River drainage is now restricted to unbaited single-hook artificial lures the entire year.

## **TOGIAC RIVER**

### **Fishery Description**

The bulk of the Togiak River coho salmon fishery occurs in the lower 20 miles of the Togiak River below the Wilderness boundary of the Togiak National Wildlife Refuge (Figure 10). The sport fishery occurs from early August to the middle of September, usually peaking between August 21 and September 7. Angler effort is largely nonresident guided anglers who access the river by flying out from nearby lodges to fish for the day. In addition, there are a couple of river-based lodges that cater to nonresident anglers, one of which is owned by the local native corporation in Togiak and leased to a concession group.

### **Historical Performance**

Sport harvest of coho salmon from the Togiak River averaged 683 fish annually from 1993 through 1997, or about 2% of the total Togiak River coho salmon harvest (Table 19). Annual sport harvest peaked in 1986 at 2,851. Low run strength and ensuing restrictions in the sport fishery in 1990 and 1991, cancellation of a local salmon derby sponsor, and a general downturn in lodge business about 1992 and 1993 resulted in reduced sport harvests during the early 1990s. The 1996 run was an unexpectedly and unusually abundant return. A high degree of voluntary catch-and-release has been documented for this fishery and ranges from 40% to 60% of the catch. Concern over hook-induced mortality, given previous department studies (Vincent-Lang et al. 1993), prompted staff to evaluate the potential hook-and-release mortality. The department concluded that although the released proportion of the catch was large, the total number of fish caught is small in terms of the total run. Therefore, catch-and-release affects only a small number of fish and is expected to have a minor impact on the overall health of the stocks. In addition, department studies (Vincent-Lang et al. 1993) have demonstrated that the mortality of released coho salmon is low when catches are made above the intertidal area, as in the case of most of the Togiak River fishery.

Commercial catches have been erratic, ranging from a high of 111,829 fish in 1980 to a low of 1,284 in 1987. Average commercial harvest from 1993 through 1997 was 34,349, accounting for 96% of the total Togiak coho salmon harvest (Table 19). Over the recent 5 years, the commercial harvests have been quite erratic, but on average have increased from levels recorded for the 1987 through 1993 seasons.

Subsistence harvests are probably stable, and have recently ranged from 200 to 900 fish per year (Table 19). Much of the range in the subsistence harvest is related to variability of reporting rather than actual fluctuations in take.

### **Management**

Sport harvest and effort is estimated through the statewide mail survey and reported by Mills (1979-1994) and Howe et al. (1995-1999). Commercial and subsistence harvests are monitored

**Table 19.-Coho salmon commercial, subsistence, and sport harvest plus escapement for the Togiak River, 1977-1998.**

Year	Harvest				Escapement <sup>b</sup>	Total Run
	Commercial <sup>a</sup>	Subsistence	Sport	Total		
1977	33,824	1,100	114	35,038		
1978	36,959	500	214	37,673		
1979	80,073	700	300	81,073		
1980	111,829	1,200	258	113,287	65,130	178,417
1981	19,504	2,200	119	21,823	43,500	65,323
1982	107,927	1,300	524	109,751	69,900	179,651
1983	4,977	800	294	6,071	NS <sup>c</sup>	
1984	111,631	3,800	1,295	116,726	60,840	177,566
1985	35,765	1,500	342	37,607	33,210	70,817
1986	28,030	500	2,851	31,381	21,400	52,781
1987	1,284	1,600	409	3,293	60,000	63,293
1988	8,744	792	1,238	10,774	65,000	75,774
1989	35,814	976	1,976	38,766	NS <sup>c</sup>	
1990	2,296	1,111	367	3,774	21,390	25,164
1991	4,262	1,238	500	6,000	25,560	31,560
1992	3,918	1,231	251	5,400	80,100	85,500
1993	12,613	743	330	13,686	NS <sup>c</sup>	
1994	88,522	910	531	89,963	NS <sup>c</sup>	
1995	8,910	703	408	10,021	NS <sup>c</sup>	
1996	58,722	199	1,400	60,321	64,980	125,301
1997	2,976	260	746	3,982	20,625	24,607
All Years Avg.	38,028	1,113	689	39,829	48,587	88,416
Percent	95%	3%	2%			
1993 - 1997 Avg	34,349	563	683	35,595	42,803	78,397
Percent	96%	2%	2%			
1998 <sup>d</sup>	52,630	310	1,241	54,181	25,335	79,516
Percent	97%	1%	2%			

<sup>a</sup> Commercial harvests are from Togiak Section of Togiak District.

<sup>b</sup> Escapement estimates are based on fixed-wing aerial surveys, and are expanded to account for missed fish, except 1987 and 1988 which are based on sonar estimates.

<sup>c</sup> NS = no survey or incomplete survey; no total run estimate possible.

<sup>d</sup> 1998 harvest estimates are preliminary.

by the Commercial Fisheries Division and are reported in their Annual Management Report series (ADF&G 1998a, 1999b). Sport Fish Division last conducted significant monitoring and stock assessment projects in 1984 and 1989 (Minard and Lisac 1984, Dunaway 1990b). When weather and water conditions permit, the Commercial Fisheries Division estimates annual spawning escapement of Togiak River coho salmon by conducting aerial escapement index counts (Weiland et al. 1999).

The bag and possession limit for coho salmon on the Togiak River is 5 per day with no size limit. The limit was adjusted three times in recent years in response to conservation concerns. In 1987, when it appeared the escapement goal for coho salmon would not be achieved, the fishery was restricted to catch-and-release. In 1990 and 1991, the bag limit was dropped to 1 per day and in possession. In 1995 the department again reduced the bag limit to 2 coho salmon per day based on a poor parental year return, very low commercial catches and low aerial survey counts in the river. For years when parental escapements have been adequate, such as 1996, the current bag limit of 5 has been satisfactory, but in poor years the department has responded with emergency order authority to reduce overall harvest.

### **Management Objectives**

The escapement goal for the Togiak River drainage is 50,000 coho salmon as estimated by expanding aerial survey counts for missed fish. This fishery has been successfully managed to achieve the escapement goal in only 7 of the 14 years for which estimates are available.

### **1998 Season**

The 1998 Togiak coho salmon return was expected to be average or slightly above average based upon parental year (1994) fishery performance. As the season developed the coho salmon returns appeared to be average or better throughout much of Bristol Bay, and a good return was anticipated in the Togiak River as well.

However, aerial surveys of the Togiak River coho salmon escapement, conducted in October by the Division of Commercial Fisheries, indicated the goal of 50,000 was not achieved. The low escapement was a surprise, given that inseason flights indicated good rates of escapement. At one point, an estimated 30,000 coho were holding in the lower reaches of the river. Reported illegal commercial harvests from the lower Togiak River are suspected to have contributed significantly to the low final escapement estimate.

The total sport harvest was estimated to be 1,241 in 1998 (Howe et al. 1999), the commercial fishery took 52,630 coho salmon, and the subsistence fishery reported only 310 coho taken (Table 19). The final spawning escapement surveys estimated 25,335 coho salmon, only half the escapement goal. No inseason adjustments had been made in the sport fishery due to the inseason information that showed escapements into the system were likely to achieve the 50,000 fish goal.

### **1999 Outlook**

The 1995 coho salmon escapement into the Togiak River, parent year for the 1999 return, was not estimated. The 1995 commercial harvest of 8,910 fish was the lowest recorded since 1992. Subsistence and sport harvests were about average. Based on parent year fishery performance, the 1999 return of coho salmon to the Togiak River may be average or below. If the return materializes as anticipated, the sport fishery will proceed under the published regulations with no



further restrictions necessary in the sport fishery. If the run is found to be weak, and inseason restrictions to the sport fishery become necessary, management will strive to maintain some angling opportunity without harming the biological integrity of the run. We intend to closely watch the commercial fishery and other indicators to ensure adequate escapement is achieved.

## **NORTHWESTERN COHO SALMON FISHERIES**

The Kuskokwim River and its tributaries sustain one of the largest coho salmon returns in Alaska, usually producing a combined commercial and subsistence harvest of 200,000 to over 600,000 fish annually. This run passes through the Northwestern section of the SWMA. Present exploitation by sport anglers is light but increasing. Prior to 1992, annual sport harvests from the Northwestern section contributed 6% to 13% of the SWMA's total sport harvest and since 1992 have ranged from 15% to 25%. From 1987 to 1996, the annual Kuskokwim River coho salmon harvest by all fisheries averaged close to 700,000 fish. The sport harvest represents less than 1% of that harvest. From 1993 through 1997, the sport harvest in this section averaged 1,855 fish annually (Table 15). The few services catering to recreational anglers and the difficulty of access hinders sport fisheries for all species in this section.

### **1998 Season**

The 1998 coho salmon run in the Kuskokwim River was well below average. The commercial fishery was restricted to seven 6-hour openings (1 per week ) in the lower river and two openings in the upper, W-2, district. Total commercial harvest was 210,481 coho salmon, less than half of the average of the previous 10 years (545,658) (Burkey et al. 1999b). During the month of August, Sport Fish staff participated in several of the Kuskokwim Working Group meetings to stay abreast of the coho run assessment work, the Group's commercial fishery recommendations, and status of the subsistence fisheries. Restrictions were not issued for the sport fishery because the harvest is so small, the fishery is very widely dispersed, and restrictions would have provided no perceptible biological gain.

### **1999 Outlook**

There is no formal forecast for Kuskokwim coho salmon. However, in 1995, the parent year for the 1999 coho salmon return, the commercial harvest was 471,461 fish (Burkey et al. 1999b); somewhat below the 1988-1998 (excluding 1995) average of 550,000 coho. Other sources of information indicated the spawning escapement of coho salmon in the drainage was good. The 25,000 fish escapement goal at the Kogrukluq weir was exceeded by about 2,800 coho salmon (Burkey et al. 1999b). If the offspring of the 1995 run survived at average or better levels, the 1999 return is likely to be average. It should be noted, however, coho salmon often exhibit very erratic rates of return. The limited data available render this commentary to no more than educated speculation. Management of all fisheries will be based on inseason indications of run strength.

## SECTION V: SOCKEYE SALMON FISHERIES

Sockeye salmon is the most numerous of the Pacific salmon species to spawn in Bristol Bay, the world's largest producer of sockeye salmon. Their prized eating qualities make sockeye salmon the most popular species of salmon on the commercial market. Traditionally, sockeye salmon have not enjoyed the popularity with anglers they grant to other species due to their indifference to most fishing lures. Since the late 1960s however, anglers have discovered innovative ways to legally catch sockeye salmon with customary sport gear, and the species has gained favor as a hard fighting as well as delectable game fish. The most popular fisheries exist in the Naknek and Kvichak drainages (Figure 12).

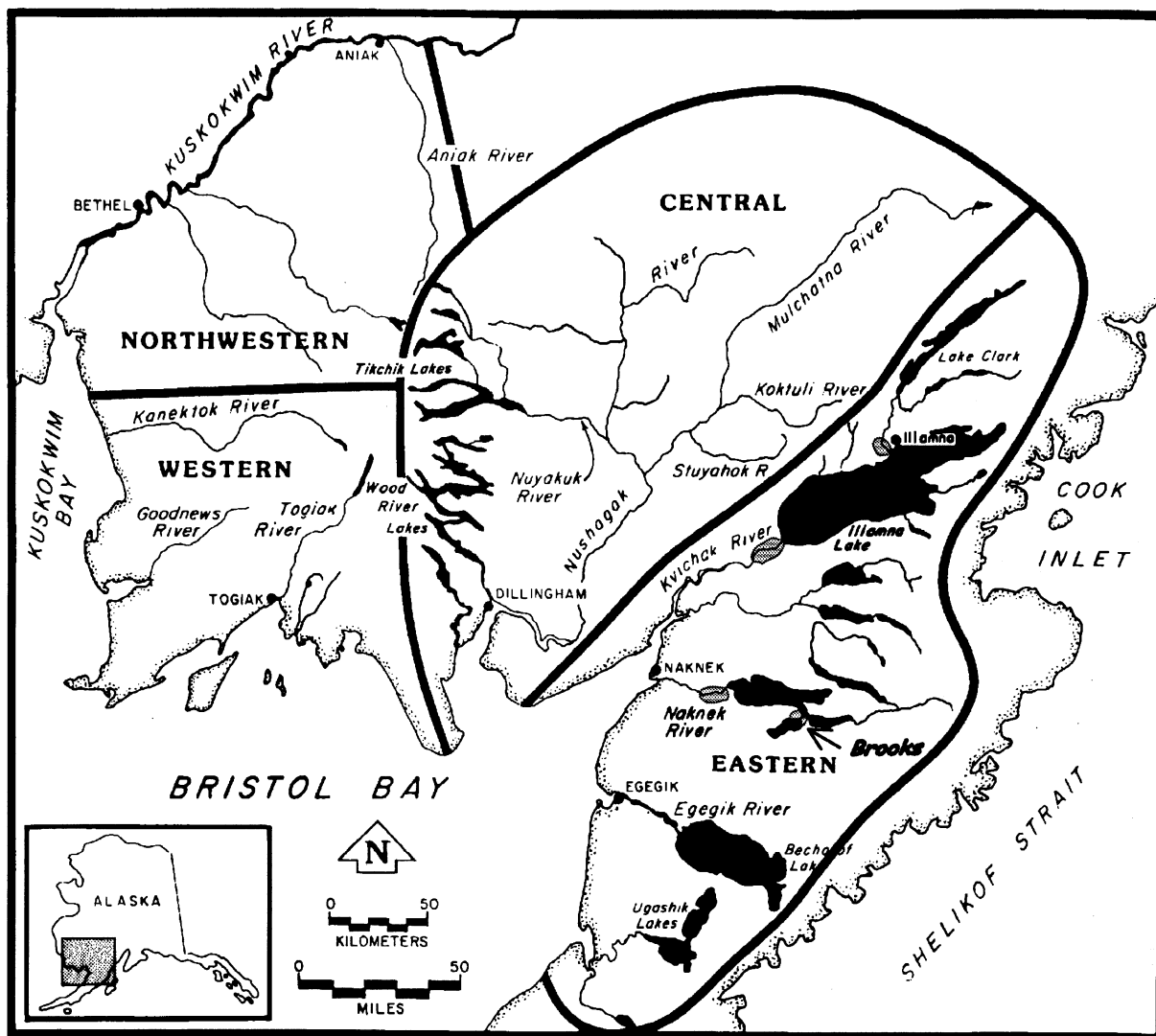


Figure 12.-Popular sockeye salmon sport fisheries in Southwest Alaska.

Harvests of sockeye salmon in the SWMA were stable at 3,000 to 4,000 fish from 1977 through 1981, then increased from 6,000 to 10,000 fish starting from 1982 to 1988 (Table 20, Figure 13). After 1988, the sport harvest of sockeye salmon increased substantially in number and variability with a peak estimate of nearly 33,000 fish taken in 1989 and lows of about 16,000 fish in a number of years. From 1993 through 1997 the sport harvest averaged 19,304 sockeye salmon per year (Table 20). The most active sport fisheries occur in the Eastern section of the management area, where more than 16,000 fish or 85% of the annual harvest is taken. The Central section fishery harvests about 2,000 sockeye per year and harvests in the Western and Northwestern sections provide annual harvests of about 500 and 200 fish, respectively (Table 20). Even with the elevated harvests of recent years, the sport harvest is a minute 0.04% of the millions of sockeye salmon returning to spawn in the area. Roughly 60% of the annual Bristol Bay sockeye total return has been taken in the commercial fishery since 1980, and 168,000 fish, or less than 1% of the run, have been harvested by subsistence fishermen.

Sockeye salmon share the same bag and possession limit with all salmon except chinook: 5 salmon per day, no size limit. This regionwide limit has been in effect since 1972. The department's ability to manage for sustained yield is essentially unaffected by the recreational harvest of sockeye salmon. No adjustments have been made to the bag and possession limits in the past and none were made in 1998 (see Kvichak River below). Sockeye salmon are expected to play an increasingly important role in the development and expansion of the recreational fishery in Southwest Alaska.

## **BROOKS RIVER**

### **Fishery Description**

Brooks River, which drains Brooks Lake into Naknek Lake, is a 2-mile long stretch of water located within the boundaries of the Katmai National Park and Preserve (Figure 12). Brooks Camp, located on Naknek Lake, was established in 1960 by Northern Consolidated Airlines as primarily a sport fishing facility, but in recent years has also become popular with tourists for hiking and bear viewing opportunities. Access to Brooks River and Brooks Camp is by float-equipped aircraft or boat. Beside guest cabins, a campground facility is available for overnight visitors. At the lower end of Brooks River is a foot bridge which allows visitors to cross between the south and north shores without wading. The sport fishery for sockeye salmon generally takes place below the bridge in the lower quarter mile of the river where it empties into Naknek Lake. The sockeye salmon fishery begins in late June when the first salmon arrive and peaks over the Fourth of July weekend. The recreational fishery occupies waters also used by brown bears fishing for salmon. This overlap has caused management problems and conflicts for the Department of Fish and Game and the National Park Service. At issue is the safety of visitors and the priority that the different groups (bear viewers, sport fishermen, hikers) should have. According to the Final Development Concept Plan Environmental Impact Statement for the Brooks River Area (NPS 1996), the service's preferred action is to significantly curtail or restrict sport fishing opportunity on the Brooks River, particularly the sockeye salmon fishery downstream from the bridge.

**Table 20.-Sport harvest of sockeye salmon from the waters of Southwest Alaska by fishery, 1977-1997.**

Drainage	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Eastern											
Ugashik	213	127	189	379	11	126	55	100	12 <sup>a</sup>	0 <sup>a</sup>	370
Egegik/Becharof	144	56	31	34	0	42	137	37 <sup>a</sup>	25 <sup>a</sup>	92 <sup>a</sup>	173 <sup>a</sup>
Naknek R.	78	345	236	542	184	534	644	436	1,157	107	69
Naknek L.	165	42	299	112	140	73	137	37	50 <sup>a</sup>	0 <sup>a</sup>	173
Bay of Islands							0	75	0	15 <sup>a</sup>	23
Brooks R.	135	113	79	121	43	157	284 <sup>b</sup>	449	299	566	1,097
Brooks L.											
American Cr.							0 <sup>a</sup>	0 <sup>a</sup>	50 <sup>a</sup>	15 <sup>a</sup>	23 <sup>a</sup>
King Salmon R.											
Kvichak R.	583	380	283	654	400	639	603	898	1,827	102	1,805
Copper R.	62	183	252	122	281	1,038	1,206	75 <sup>a</sup>	127 <sup>a</sup>	0 <sup>a</sup>	82 <sup>a</sup>
Alagnak R.					11	0	21	100	127	544	54
Newhalen R.	805	1,479	1,163	715	1,490	1,786	1,671	2,581	2,623	238	4,185
L Talarik Cr.	58	0	47	0	22	0	0	187 <sup>a</sup>	53	0 <sup>a</sup>	0 <sup>a</sup>
Lake Clark	420	648	1,022	155	292	220	603	449	106	0	110
Lake Iliamna							41 <sup>a</sup>	474 <sup>a</sup>	382 <sup>a</sup>	272	602
Kulik R.											
Tazimina R.											
Moraine Cr.											
Other	8	113			22		247	74	612	0	421
Subtotal	2,671	3,486	3,601	2,834	2,896	4,615	5,649	5,972	7,450	1,951	9,187

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**Table 20.-Page 2 of 4.**

Drainage	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	5-Year Average
Eastern											
Ugashik	340 <sup>a</sup>	884	20	77	8	174	263	96	726	738	399
Egegik/Becharof	0 <sup>a</sup>	1,040	183	96	485	149	90	556	33	316	229
Naknek R.	1,082	598	835	979	641	946	575	925	762	270	696
Naknek L.	62 <sup>a</sup>	286	10	163	90	106	142	66	24	91	86
Bay of Islands	31 <sup>a</sup>	364	0	106	41	0	44	89	0	62	39
Brooks R.	557	702	1,181	624	904	586	331	567	609	507	520
Brooks L.			753	134	123	101	19	56	60	25	52
American Cr.	0 <sup>a</sup>	26	51	0 <sup>a</sup>	0	0	0	11	71	0	16
King Salmon R.					0	0	9	0 <sup>a</sup>	24 <sup>a</sup>	0 <sup>a</sup>	7
Kvichak R.	526	4,769	2,988	1,249	1,964	2,923	4,001	3,811	2,139	778	2,730
Copper R.	93 <sup>a</sup>	378	246	707	148	818	844	391	426	306	557
Alagnak R.	124 <sup>a</sup>	479	562	502	608	3,179	725	1,496	1,375	1,884	1,732
Newhalen R.	2,414	14,508	6,093	9,523	6,509	9,889	7,973	7,859	4,795	4,440	6,991
L Talarik Cr.	186 <sup>a</sup>	151 <sup>a</sup>	0	82	329	78	38	125	96	0	67
Lake Clark	0 <sup>a</sup>	252	246	143	510	297	782	800	91	515	497
Lake Iliamna	619	1,741	474	788	1,011	1,431	849	1,469	418	418	917
Kulik R.					0	0	0	0	0	0	0
Tazimina R.					197	58	275	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	67
Moraine Cr.					0	0	0	0	0	0	0
Other	589	1,404	167	301	536	836	1,051	680	631	897	819
Subtotal	6,623	27,582	13,809	15,474	14,104	21,571	18,011	18,997	12,280	11,247	16,421

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**Table 20.-Page 3 of 4.**

Drainage	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Central											
Nushagak	94	310	204	60	140	796	1,123	236	260	88	274
Mulchatna	280	56	79	17	0	199	397	536	14	1,548	301
Agulowak											
Agulukpak											
Wood River L.	129	211	110	112	270	461	466	100	506	876	109
Tikchik/Nuyakuk	16	99	16	34	65	105	123	25	0	58 <sup>a</sup>	27 <sup>a</sup>
Koktuli											
Other					0	0	68	124	0	204	246
Subtotal	519	676	409	223	475	1,561	2,177	1,021	780	2,774	957
Western											
Togiak	14	183	393	69	108	241	69	75	116 <sup>a</sup>	0	27 <sup>a</sup>
Goodnews							14	156 <sup>a</sup>	75	24 <sup>a</sup>	49 <sup>a</sup>
Kanektok							0	143	12	200	153
Arolik											
Other							0	0	0	0	
Subtotal	14	183	393	69	108	241	83	374	203	224	229
Northwestern											
Aniak							0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	28 <sup>a</sup>
Kisaralik											
Kwethluk											
Other							0	0	12	98	42
Subtotal							0	0	12	98	70
Eastern	2,671	3,486	3,601	2,834	2,896	4,615	5,649	5,972	7,450	1,951	9,187
Central	519	676	409	223	475	1,561	2,177	1,021	780	2,774	957
Western	14	183	393	69	108	241	83	374	203	224	229
Northwestern							0	0	12	98	70
Total	3,204	4,345	4,403	3,126	3,479	6,417	7,909	7,367	8,445	5,047	10,443

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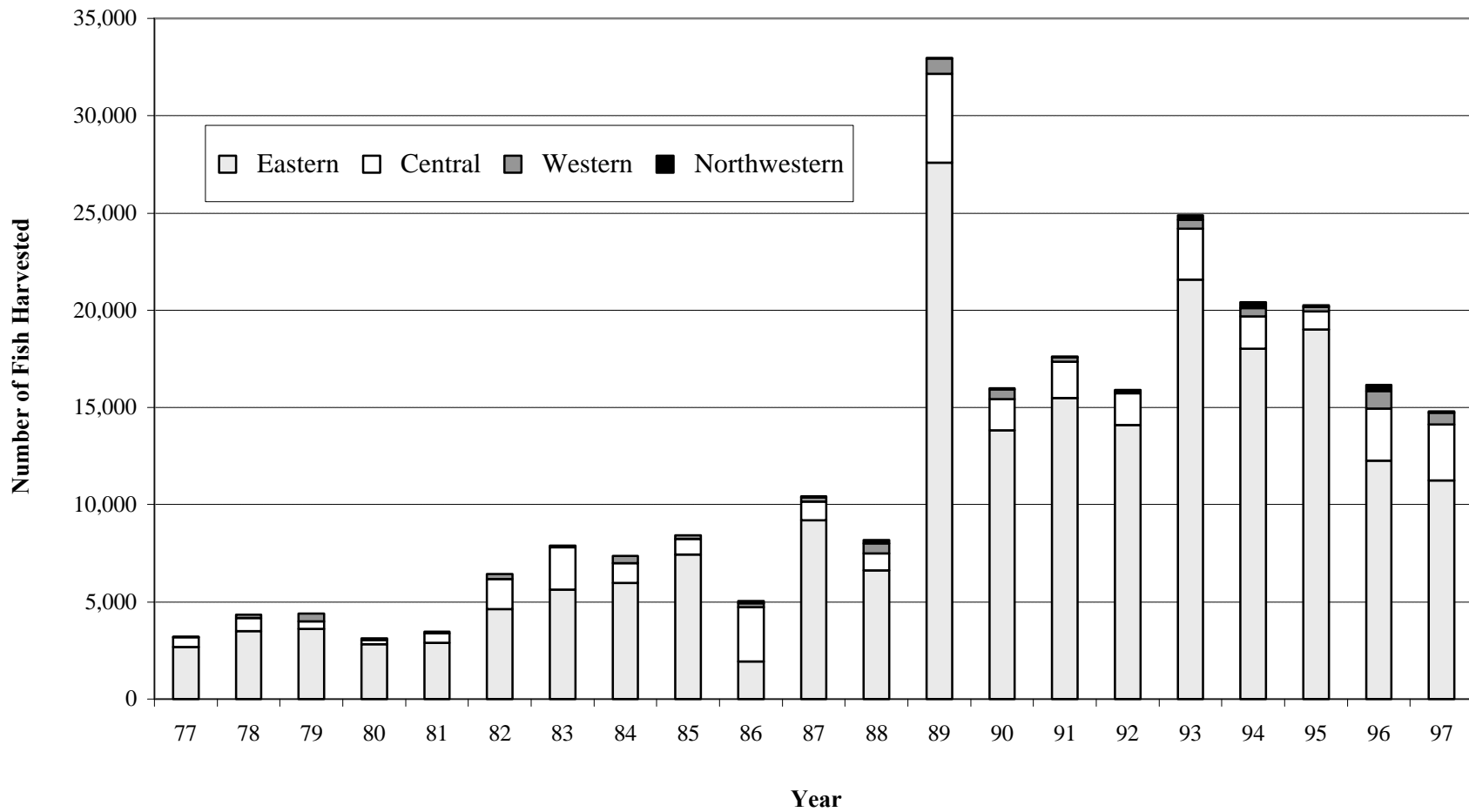
**Table 20.-Page 4 of 4.**

Drainage	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	5-Year Average
<b>Central</b>											
Nushagak	279	338	184	480	608	521	432	153	933	520	512
Mulchatna	433	390	532	280	288	568	219	153	444	474	372
Agulowak										297 <sup>a</sup>	297
Agulukpak										162 <sup>a</sup>	162
Wood River L.	93	2,105	522	840	526	505	813	539	874	1,163	779
Tikchik/Nuyakuk	31	598	20	150	58	557	54	32	62	0	141
Koktuli R.					156	95	96	32 <sup>a</sup>	199	0 <sup>a</sup>	84
Other	31	1,141	346	120	0	391	63	45	153	272	185
Subtotal	867	4,572	1,604	1,870	1,636	2,637	1,677	954	2,665	2,888	2,164
<b>Western</b>											
Togiak	62 <sup>a</sup>	416	10	80	16	61	26	22	480	224	163
Goodnews	164 <sup>a</sup>	146	62 <sup>a</sup>	63	8	53	70	34	87	70	63
Kanektok	109	101	462	88	66	331	313	148	335	290	283
Arolik										0 <sup>a</sup>	0
Other	182	112	0	0	0	0	0	0	0	0	0
Subtotal	517	775	534	231	90	445	409	204	902	584	509
<b>Northwestern</b>											
Aniak	164 <sup>a</sup>	22	49	38	25	17	17	43	66	85	46
Kisaralik							0	0 <sup>a</sup>	0 <sup>a</sup>	12 <sup>a</sup>	3
Kwethluk					0	19	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	4
Other	0	11	0	0	57	200	299	52	240	0	158
Subtotal	164	33	49	38	82	236	316	95	306	97	210
<b>Summary</b>											
Eastern	6,623	27,582	13,809	15,474	14,104	21,571	18,011	18,997	12,280	11,247	16,421
Central	867	4,572	1,604	1,870	1,636	2,637	1,677	954	2,665	2,888	2,164
Western	517	775	534	231	90	445	409	204	902	584	509
Northwestern	164	33	49	38	82	236	316	95	306	97	210
<b>Total</b>	<b>8,171</b>	<b>32,962</b>	<b>15,996</b>	<b>17,613</b>	<b>15,912</b>	<b>24,889</b>	<b>20,413</b>	<b>20,250</b>	<b>16,153</b>	<b>14,816</b>	<b>19,304</b>

Source: Mills 1977-1994, Howe et al. 1995-1998. Unless otherwise noted, these are published estimates for sites that garnered 12 or more responses in the Statewide Harvest Survey.

<sup>a</sup> Unpublished estimates from Statewide Harvest Survey for sites with less than 12 responses.

<sup>b</sup> Estimates from onsite creel survey.



**Figure 13.-Sport harvest of sockeye salmon, by section, from the Southwest Alaska Management Area, 1977 to 1997.**



## **Historical Performance**

The abundance of sockeye salmon at Brooks River is a function of the escapement into the Naknek River. The Naknek drainage escapement goal is 1.0 million sockeye salmon. The magnitude of the escapement dwarfs the historical sport harvest so that variations in inriver abundance have little effect on fishery performance at Brooks River. Harvests of sport-caught sockeye salmon at Brooks River have ranged from a low of 43 in 1981 to a high of 1,181 in 1990 (Table 20). The recent 5-year (1993-1997) average annual harvest of 520 fish can be easily sustained by this run.

The great publicity given the relatively poor sockeye returns and commercial fishery in Bristol Bay in recent years seem to have depressed sport angling activity as well. A number of the more popular locations received much less effort in 1997 and 1998. In some cases there were still plenty of sockeye salmon available for the recreational fishery but little activity. However, being at the right place at the right time to catch the fish was often more difficult with the smaller runs.

## **Management**

Sport harvest and effort are estimated through the statewide harvest survey and reported by Mills (1979-1994) and by Howe et al. (1995-1999). Commercial and subsistence harvests are monitored by the Commercial Fisheries Division and are reported in their Annual Management Report series (ADF&G 1998a, 1999b). Sport Fish Division has not conducted any significant monitoring or stock assessment projects for this fishery in recent seasons. Forecasts of next season's return are provided by the Commercial Fisheries Division and are reported in a statewide salmon forecast summary (Geiger and Hart 1999). Escapement of sockeye salmon in the Brooks River is estimated from fixed-wing aerial surveys during the presumed peak of spawning. Survey results were most recently reported in Weiland et al. (1999)

The 1982 memorandum of understanding between the Department of Fish and Game and the Department of Interior clearly places management authority for fishery resources of Brooks River with the Department of Fish and Game, and management of use levels and habitat protection with the National Park Service. This management structure has lead to a complicated history of regulation regarding the sport fishery. Current regulations for Brooks River allow the keeping of 1 fish per day and in possession except rainbow trout which are managed for catch-and-release fishing. Anglers are restricted to single-hook artificial lures below the foot bridge and unbaited single-hook artificial flies above the bridge. The current regulations are the result of a total revamping of the regulations in 1990 as part of the development of a rainbow trout management plan for the area. Over the years, significant concessions of sport fishing opportunity have been made under the premise of ensuring the safety of sport anglers using the Brooks River. These concessions include reductions in bag limits from 5 sockeye salmon to 1, restrictions in terminal tackle to include single-hook artificial lures below the bridge, and fly-fishing-only above the bridge.

The Park Service has adopted regulations requiring anglers to immediately place a harvested fish in a plastic bag and proceed to the cleaning house with the fish for cleaning and storage. The objective is to avoid conditioning bears to link fish harvested by sport fishermen with an easy meal. Since the early 1990s the NPS has been inconsistent in their enforcement of their fish handling regulations, and bears have occasionally stolen fish that were illegally kept along the river. On occasion, public and angling access in the immediate vicinity of Brooks River has been

temporarily restricted by the Service. Such restrictions have typically occurred in mid July at the peak of the sockeye run, were imposed after some incident, and terminated within a period of 2 to 3 weeks. The degree of coordination concerning these restrictions with the department of Fish and Game and NPS has been variable but improved in recent years.

The general erosion of angling opportunities as well as difficulties coordinating emergency management actions emphasize the need for a long-range management plan for the sockeye salmon sport fishery. Angling opportunity for Brooks River sockeye salmon will continue to be eroded and replaced with other activities unless the National Park Service and the Department of Fish and Game can develop a plan that will be supported by both agencies.

### **Management Objectives**

Naknek River sockeye salmon stocks are managed to achieve a biological escapement of 1.1 million. The Brooks River is managed to provide an average of 5,000 angler-days per year and a diversity of angling opportunity by providing a special management area restricted to unbaited single-hook artificial flies.

### **1998 Season**

Escapement of sockeye salmon into the Naknek drainage totaled 1,202,172; successfully achieving the goal of 1.1 million fish (ADF&G 1999b). The large escapement into the Naknek River system provided plenty of sockeye in Brooks River. Angling success was reported to have been good to excellent for sockeye salmon and no restrictions were imposed on the sport fishery for bears or other problems.

### **1999 Outlook**

The inshore run forecast for the 1999 sockeye salmon return to the Naknek River is 2.8 million fish (Table 21). Meeting the 1.1 million escapement goal will leave 1.7 million salmon to be harvested. Given the expected level of escapement into the Naknek drainage, there should be plenty of sockeye salmon at Brooks River this season. Good to excellent sport fishing opportunity is expected from late June through July 20.

Park Service and ADF&G staff will continue to monitor human use and will work together should it become necessary to take actions for the safety of visitors and anglers.

## **KVICHAK RIVER**

The Kvichak River drainage (Figure 12) hosts the single largest sockeye salmon run in the world and the river itself is a popular destination for anglers targeting this species. Two locations within the drainage support significant sport fisheries for sockeye salmon. First to occur is the fishery on the Kvichak River at the outlet of Lake Iliamna. The other, often larger fishery which occurs on the Newhalen River near the community of Iliamna, is discussed further in this report. Other smaller tributaries within the drainage are fished much less intensively and sport harvests are relatively minor.

### **Fishery Description**

Sockeye salmon first appear in the Kvichak River during the last week of June. The run peaks in the first week of July, then declines steadily until late July or early August.

Anglers prefer to fish this medium-sized river's clear waters during the first half of the run when the salmon are more readily taken on sport gear. A modern airstrip in the village of Igiugig

**Table 21.-1999 Bristol Bay sockeye salmon forecast.**

District/ River	Number of Sockeye Salmon		
	Bristol Bay Inshore Run		
	Total Return	Spawning Goal	Estimated Harvest
NAKNEK-KVICHAK			
Kvichak	11,500,000	6,000,000	5,500,000
Branch (Alagnak R.)	400,000	190,000	210,000
Naknek	2,800,000	1,100,000	1,700,000
Total	14,700,000	7,290,000	7,410,000
EGEGIK	3,600,000	1,100,000	2,500,000
UGASHIK	1,400,000	850,000	550,000
NUSHAGAK			
Wood	3,300,000	1,000,000	2,300,000
Igushik	700,000	200,000	500,000
Nushagak/ Mulchatna	900,000	550,000	350,000
Total	4,900,000	1,750,000	3,150,000
TOGIAC	300,000	150,000	150,000
TOTAL BRISTOL BAY	24,900,000	11,140,000	13,760,000

From: Geiger and Hart 1999.

provides easy access to the river where it drains out of Lake Iliamna, and float planes can land on the lake or on the river. Although much of the sport effort is from nonresident guided anglers, a growing component is the resident unguided angler arriving from Anchorage in private or charter aircraft.

Since most of the uplands along the upper Kvichak River are owned by the Igiugig Native Corporation, anglers may expect to pay modest daily fees for access, and commercial operators are expected to pay more substantial fees for annual leases.

### Historical Performance

The Kvichak River drainage sockeye salmon run has long been known for its 5-year abundance cycle. Peak returns occur on the fifth and tenth year of each decade: 1975, 1980, 1985, etc. (Table 22). The first and second years following a peak abundance year are the lowest annual returns in the cycle, such as 1976, 1981, and 1982, and 1996 and 1997 (Table 22). In the

**Table 22.-Historic sockeye salmon harvests and escapements for the Kvichak River, 1974 to 1998.**

Year	Commercial <sup>a</sup> Harvest	Subsistence <sup>b</sup> Harvest	Sport Harvest			Total Harvest	Escapement <sup>e</sup>
			Kvichak River <sup>c</sup>	All Other Tributaries <sup>d</sup>	Total		
1974	148,595	98,015				246,610	4,433,844
1975	1,605,407	115,516				1,720,923	13,140,450
1976	1,458,180	75,936				1,534,116	1,965,282
1977	739,464	71,940	583	1,353	1,936	813,340	1,341,144
1978	3,815,636	83,859	380	2,423	2,803	3,902,298	4,149,288
1979	13,418,829	65,520	283	2,484	2,767	13,487,116	11,218,434
1980	12,743,074	72,556	754	892	1,646	12,817,276	22,505,268
1981	5,234,733	75,554	400	2,107	2,507	5,312,794	1,754,358
1982	1,858,475	61,375	639	3,044	3,683	1,923,533	1,134,840
1983	16,534,901	96,580	603	3,768	4,371	16,635,852	3,569,982
1984	12,523,803	100,514	898	3,840	4,738	12,629,055	10,490,670
1985	6,183,103	86,426	1,827	3,603	5,430	6,274,959	7,211,046
1986	787,303	59,423	102	510	612	847,338	1,179,322
1987	3,526,824	72,630	1,805	5,400	7,205	3,606,659	6,065,880
1988	2,654,364	75,223	526	3,901	4,427	2,734,014	4,065,216
1989	11,456,509	72,050	4,769	18,434	23,203	11,551,762	8,317,500
1990	10,468,631	76,600	2,988	7,226	10,214	10,555,445	6,970,020
1991	3,837,923	66,786	1,249	11,544	12,793	3,917,502	4,222,788
1992	5,678,494	72,148	1,964	9,240	11,204	5,761,846	4,725,864
1993	5,239,770	74,123	2,923	13,407	16,330	5,330,223	4,025,166
1994	13,840,448	64,343	4,001	11,812	15,813	13,920,604	8,337,840
1995	17,509,862	54,679	3,811	11,324	15,135	17,579,676	10,038,720
1996	8,187,720	54,872	2,139	5,826	7,965	8,250,557	1,450,578
1997	182,000	59,508	778	5,679	6,457	247,965	1,503,732
1974-1997 Avg. Percent	6,651,419 99%	75,257 1%	1,592	6,087	7,678 <0.01%	6,734,354	5,992,385
1993-1997 Avg. Percent	8,991,960 134%	61,505 1%	2,730	9,610	12,340 <0.01%	9,065,805	5,071,207
1998 <sup>f</sup>	1,072,760	53,656	3,495	11,127	14,622	1,141,038	2,296,074

<sup>a</sup> Estimated Kvichak River fish only - captured in Naknek Kvichak District commercial fishery.

<sup>b</sup> 1975-1988 based upon permits issued to Kvichak watershed communities. 1989-1997 based upon Kvichak watershed fishing sites indicated on permits (updated 1997 personal communication). Significant portions of the subsistence harvests were taken above the counting tower; and total run cannot be calculated at this time.

<sup>c</sup> Kvichak River sport harvest only; estimated by Mills 1977-1994, Howe et al. 1995-1999.

<sup>d</sup> Estimated sport harvest from other tributaries of the Kvichak River excluding the Alagnak River (Mills 1979-1994, Howe et al. 1995-1999).

<sup>e</sup> Tower counts conducted at Igiugig. (ADF&G 1998a. 1999b).

<sup>f</sup> Preliminary estimates.

intervening seasons, the total abundance of Kvichak drainage sockeye salmon builds to the next peak year. The reason for this cycle is not clear and it has been the source of a number of studies and much speculation (Rogers and Poe 1984, Fried 1984, Eggers and Rogers 1987, Cross 1991, 1994, Cross et al. 1997). Once regarded as a natural phenomenon, there was a period in the 1980s and early 1990s when the cycle was thought to be an artifact of the commercial harvest (Cross et al. 1997). During the period, the Commercial Fisheries Division attempted management strategies designed to reduce or eliminate the cycle. The efforts had minimal success. Cross et al. (1997) conclude: "Available information was inconclusive about the cause of production cycles in Kvichak River, therefore, there is a great uncertainty in what levels of escapement will optimize Kvichak River's production every year." Current management of the commercial fisheries adjust annual escapement goals over a wide range according to "actual run size and a conservative exploitation rate" (Cross et al. 1997).

The Bristol Bay commercial salmon fleet harvests roughly 50% of the annual Kvichak River sockeye salmon run, and the subsistence fishery takes an average of nearly 75,000 fish annually, or about 1% of the total run. Kvichak River sockeye salmon sport harvests ranged between 300 and 600 fish per year until 1984 when nearly 900 fish were taken (Table 22).

After 1984, estimates of the sport harvest were widely erratic, ranging from 102 sockeye salmon in 1986 to nearly 4,800 in 1989. From 1993 through 1997, the annual sport harvest averaged 2,730 sockeye salmon (Table 22). Even the highest estimates of sport harvest amounted to about 2% (1989) of the total Kvichak River sockeye salmon harvest, even less of the total return, and did not jeopardize the department's ability to manage for sustained yield.

In 1995 the department conducted a benchmark survey of the sockeye salmon sport fishery near Igiugig (Dunaway and Fleischman 1996b). Harvest was found to be an important aspect of this fishery with nearly 60% of the angler trips harvesting the daily limit of 5 sockeye salmon. Virtually all anglers fished from the shore, fly tackle was used in 97% of the trips, 66% of the anglers were guided, and 81% were nonresidents (Dunaway and Fleischman 1996b). The onsite effort estimate was very similar to effort levels estimated by the annual statewide harvest survey.

## **Management**

Sport harvest and effort are estimated through the statewide harvest survey and reported by Mills (1979-1994) and by Howe et al. (1995-1999). Commercial and subsistence harvests are monitored by the Commercial Fisheries Division and are reported in their Annual Management Report series (ADF&G 1998a, 1999b). Sport Fish Division conducted a survey on this fishery in 1995 (Dunaway and Fleischman 1996b). Escapement is estimated by counts made from towers as the salmon migrate up the Kvichak River. Forecasts of each season's return are provided by the Commercial Fisheries Division and are reported in a statewide salmon forecast summary (Geiger and Hart 1999).

Kvichak River sockeye salmon stocks are managed to achieve a biological escapement goal (BEG) between 4 and 10 million fish, depending on the cycle year. For high-cycle years the point goal is set between 6 and 10 million. During off-cycle years the point goal is set between 4 and 6 million. The specific point goal is established preseason and published (Geiger and Hart 1999).

The large number of available salmon, crowding in the nearby Newhalen River fishery, and improved facilities in Igiugig are all contributing to the growth of this fishery. Increased effort in

recent years has raised the potential for conflicts between the long-existing subsistence net fishery at the village of Igiugig and sport anglers. A challenge to management of this fishery will be to provide for increased opportunity while ensuring that gear and user conflicts are addressed.

The sport fishery is actively managed to provide increased participation and opportunity. Presently, an average of nearly 5,000 angler-days per year are expended by anglers seeking rainbow trout and sockeye salmon (Table 6). The level of participation could double in 4 years by improving access to desirable fishing sites, promoting the fishery as a destination, and working to assure necessary facilities are provided to accommodate the growth in a responsible manner. To this end the department has worked closely with the Igiugig City Council on a project that would entail building trails to desirable fishing locations close to the village airfield. Initiated in 1994 with expectations to be complete by 1995, the project has been slowed by problems with easements and access to gravel supplies. The project remained incomplete in 1998.

### **Management Objectives**

The Kvichak River sockeye salmon stocks are managed to achieve a biological escapement goal (BEG) of 2 to 10 million, depending on the cycle year. In 1998, the preseason BEG was 6 million fish and the total run was expected to be 7.4 million sockeye (Hart et al. 1998).

### **1998 Season**

The run developed slowly, and by July 5 escapement estimates were so poor that severe restrictions to the commercial fisheries began to be issued. The run continued below expected levels, and commercial restrictions continued until July 12. On July 11, bag limit restrictions were nearly issued for the sport fishery. However, restrictions to the sport fishery were forestalled when the department revised its total run projection to less than 4.0 million sockeye, announced it would manage the commercial fishery to achieve the minimum escapement goal of 2.0 million, and liberalized fishing time for the commercial fishery. Escapement into the Kvichak River totaled almost 2.3 million sockeye salmon in 1998, only slightly above the alternative 2.0 million fish goal and well below the preseason escapement forecast of 4.5 million sockeye salmon (ADF&G 1999b). The total run was estimated to be about 6.3 million fish.

As in 1997, widespread publicity on the poor 1998 return resulted in significantly reduced sport effort at Igiugig and other fisheries in the drainage. Ultimately, no restrictions were issued for the sport fishery. The rationale for no action was that subsistence needs were being met, sport effort was low, and the average annual sport harvest of less than 1% of the total harvest or return is insignificant to the management and overall sustainability of the run. No monitoring program was in place in 1998. Sport anglers are estimated to have harvested 3,495 sockeye salmon from the Kvichak River proper and an additional 11,127 sockeye from other tributaries of the drainage, a significant increase over the 1997 harvests (Table 22) (Howe et al. 1998, 1999).

### **1999 Outlook**

The 1999 Kvichak drainage forecast is for a total inshore run return of over 11.5 million sockeye salmon of which 6.0 million are to be allowed into the river for spawning and inriver use (Table 21). If the inshore run projection and 6.0 million fish escapement goal materializes, anglers will have plenty of sockeye salmon available to them. The optimum fishing time will be from late June through July 16. Spotty fishing success can be expected before and after these dates. Exceptional fishing may be accessed from the village of Igiugig, where the Igiugig Native

Corporation and the Alaska Department of Fish and Game are in partnership on a sport fishing access project. The project, scheduled for completion soon, is intended to provide anglers safe and efficient access to sockeye salmon fishing waters downstream of the village. The village of Igiugig has graciously provided an easement across uplands for anglers to reach the fishing hot spots. The intention is to minimize the intermingling of sport fishermen with ongoing subsistence fishing activities immediately adjacent to the village.

## **NEWHALEN RIVER**

### **Fishery Description**

The Newhalen River is the major tributary in the Kvichak River drainage. It flows from Lake Clark into the north side of Lake Iliamna near the communities of Iliamna and Newhalen (Figure 12). Since it is further inland, sockeye salmon reach the Newhalen River a few days later than the Kvichak River and the best angling usually occurs during the middle 2 weeks of July.

The Newhalen River is more easily accessed than the Kvichak River and supports a large run of sockeye salmon. Several businesses and lodges in the town of Iliamna cater to anglers' needs and a large runway serviced by regularly-scheduled commercial airlines provides economical access from Anchorage. From the runway, a mile-long trail leads to the river. The trail ends near a series of cascades where large numbers of sockeye salmon congregate on their way to spawning grounds in the Lake Clark drainage.

### **Historical Performance**

The sockeye salmon entering the Newhalen River are one segment of the normally huge Kvichak River run. Hence, comments on the character of the commercial and subsistence harvests for the Kvichak River apply equally for the Newhalen River stocks. The sport fishery on the Newhalen River is unique for its large component of unguided anglers and for its history of regularly producing 25% to over 40% of the entire area's annual sport harvest of sockeye salmon (Table 20). For the period 1993 to 1997, the annual sport harvest averaged 6,991 sockeye salmon. No onsite studies of this fishery have been conducted by the department.

### **Management**

Sport harvest and effort are estimated through the statewide harvest survey and reported by Mills (1979-1994) and by Howe et al. (1995-1999). Commercial and subsistence harvests are monitored by the Commercial Fisheries Division and are reported in their Annual Management Report series (ADF&G 1998a, 1999b). Sport Fish Division has not conducted any significant monitoring or stock assessment projects for this fishery. Escapement is estimated by counts made from towers as the salmon migrate up the Kvichak River. Forecasts of next season's return are provided by the Commercial Fisheries Division and are reported in a statewide salmon forecast summary (Geiger and Hart 1999).

In response to the growth of the Newhalen River sport fishery, the Sport Fish Division provided funds through its Small Projects Access program to install regulatory signs, several portable toilets and bear-proof garbage facilities along the trail. These modest improvements have been received very well by the angling public and the adjacent land owners.

## **Management Objectives**

The Newhalen River sockeye salmon sport fishery is managed to provide an average of 5,000 angler-days of effort and an average harvest of 8,000 sockeye salmon per year. Escapement is addressed by achieving the biological escapement goal (BEG) for the Kvichak River.

### **1998 Season**

See the preceding section, 1998 Season for the Kvichak River sockeye salmon. No monitoring program was in place and the 1998 harvest estimate of 8,087 sockeye salmon is preliminary (Howe et al. 1999).

Local reports indicated that angling effort in 1998 was about one quarter to one half of the 200 plus anglers per day observed during the peak days of the fishery in the early 1990s. Those anglers who ventured to the Newhalen River reported fair to good success during the peak of the fishery. Though below forecast, the 1998 run was much better than those of 1996 and 1997 when sport anglers were estimated to have taken 4,795 and 4,440 sockeye salmon (Table 20) (Howe et al. 1998, 1999).

Access along the trail to the Newhalen River occurred without interruption this season. Facilities provided by the department access program continued to be used heavily by the visiting public. There have been increasing problems with bears in camps.

### **1999 Outlook**

The Newhalen River component of the Kvichak return is expected to be considerably stronger in 1999 than it has been during the recent 2 years. Fishing access via the trail from the airport to the river remains open to the public. The department has installed outhouses and signs to help manage and accommodate the demand anglers have for access to this sockeye salmon sport fishery. Peak fishing time is expected to occur during the first 2 weeks of July. Prior to and after that time the number of sockeye will be lower; however, fishing success may also be good.

## **CENTRAL SECTION SOCKEYE SALMON FISHERIES**

About 15% of Bristol Bay sockeye salmon return to the Central section. Anglers do not fish this section heavily for sockeye salmon, and sport harvests average 2,000 fish, or 11% of the area's total annual sport harvest (Table 20). Harvest of sockeye in 1998 totaled 4,486, and was the second highest reported (after 1989) for the section (Howe et al. 1999). It appears that interest in harvesting sockeye is growing. The stocks are generally healthy and virtually unaffected by the recreational harvest. Commercial fishermen take as much as 58% of the sockeye salmon run while subsistence and sport harvests are each less than 1% of the run. The waters most commonly used by sport anglers are the Nushagak River, Mulchatna River, and the Wood River lakes system.

### **1999 Outlook**

Sockeye salmon returns to the Central Section are expected to total 4.9 million with 1.75 million escaping into the river systems to provide for spawning escapement and inriver uses (Table 21). The best sockeye sport fishing opportunities will be in the Wood River and the Wood River Lake system. The best time to fish sockeye will be from June 25 to July 10.



## SECTION VI: RAINBOW TROUT FISHERIES

Wild rainbow trout stocks of the SWMA are cornerstone to a multimillion dollar recreational fishing industry. Sport fishing opportunity for both guided and unguided anglers is primarily during the ice-free season, generally from June through October. Popular waters include tributaries of the Kvichak River drainage, the Naknek River drainage, portions of the Nushagak/Mulchatna River drainages, streams of the Wood River Lakes system, the Kanektok, Goodnews, and Aniak rivers (Figure 14).

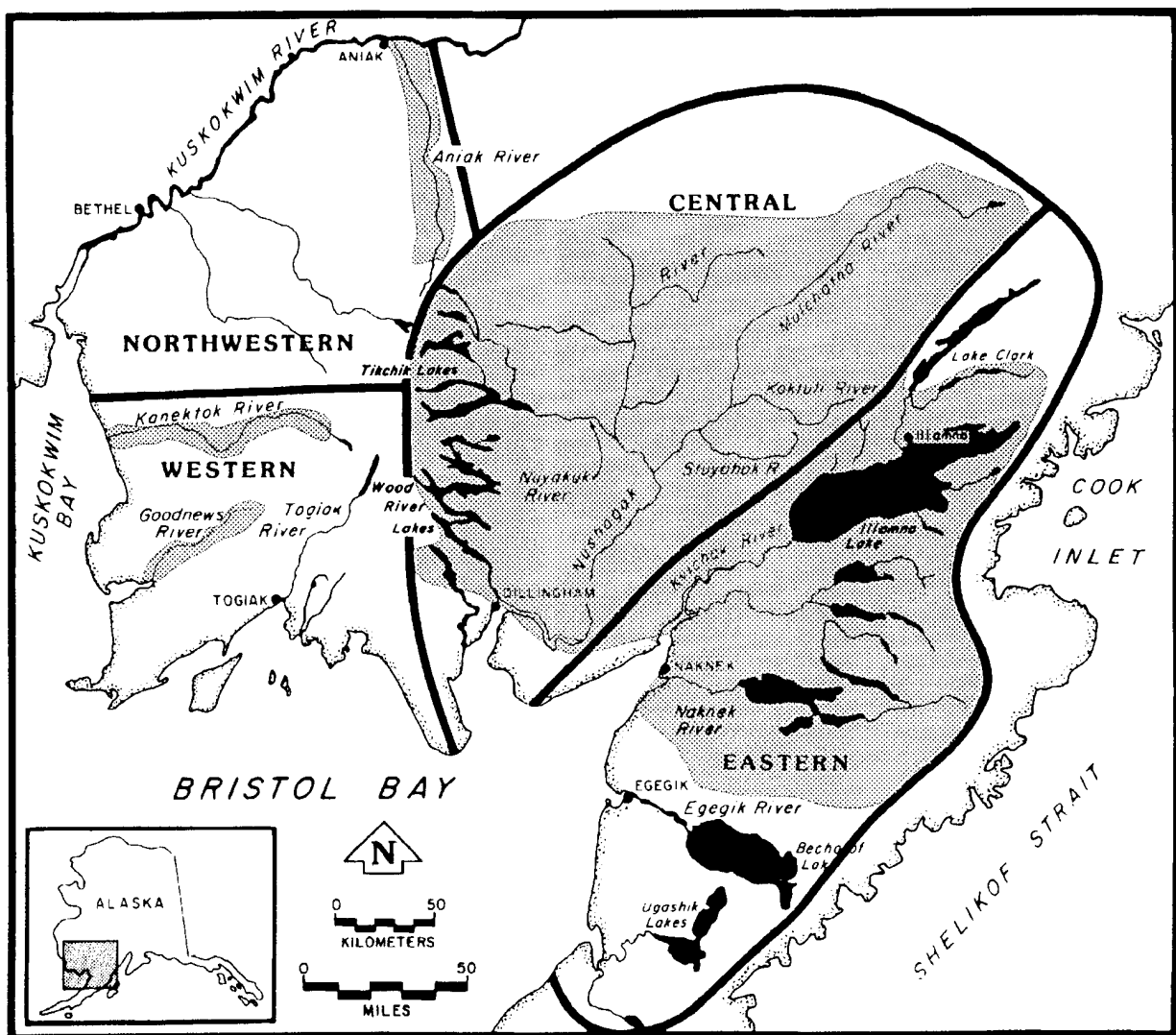


Figure 14.-Popular rainbow trout sport fisheries in Southwest Alaska.

The rainbow trout fisheries within the SWMA underwent rapid growth from the late 1970s to mid 1980s. Annual harvests climbed to 10,785 fish in 1983, averaged 5,216 fish per year from 1986 through 1991, and from 1993 through 1997 averaged 3,096 fish (Table 23). The species' importance to the recreational fisheries is not adequately described by estimates of harvest. Studies indicate that during the last 10 years, the retention rate, or the number of fish kept from the total catch, has declined steadily while the total effort and catch remained stable or increased (Minard 1989b and 1990, Brookover 1989b, Dunaway 1993). Estimates of catch (number of fish kept plus fish released) were first available in 1991 and have consistently ranged from about 122,000 fish to 202,000 fish annually (Table 24). From 1993 through 1997 the annual catch averaged 159,851 rainbow trout and appears stable. It is evident the angling public has embraced the concept of catch-and-release for rainbow trout, and has voluntarily reduced their harvests throughout the area.

The status of rainbow trout as a subsistence species is changing under the direction of the Alaska Board of Fisheries. In 1993, the Board ruled that rainbow trout, caught incidentally to other species, may be retained by subsistence users. In 1994 the Alaska Board of Fisheries recognized subsistence use of rainbow trout among all other finfish in Bristol Bay (5 AAC 01.336). These are changes from previous years where rainbow trout were explicitly excluded from harvest under the subsistence priority.

The subsistence taking of rainbow trout from nonnavigable waters located within federal land holdings (Refuges and National Parks) has been allowed since December of 1991. Since there were few, if any, significant subsistence fisheries for rainbow trout occurring on nonnavigable waters, the federal regulations had little effect on legal fishing opportunity.

Note that the Board of Fisheries has provided seasonal opportunities for harvesting rainbow trout under sport regulations by liberalizing bag limits during the off-season months (typically fall to late spring), when most local residents pursue rainbow trout for food. For example, in most waters of the SWMA, the summer bag limit is 2 rainbow trout per day, but in the winter months the limit increases to 5 rainbow trout per day. Seasonal changes in the bag limits accommodate the winter harvest needs of the few local residents but do little to jeopardize the health of local rainbow trout stocks.

## **SOUTHWEST ALASKA RAINBOW TROUT MANAGEMENT PLAN**

In February of 1990, the Alaska Board of Fisheries adopted regulations implementing a comprehensive management plan for rainbow trout in Southwest Alaska (ADF&G 1990). The plan provides guidance in the form of policy that gives the Board and the public a clear understanding of the underlying principles by which rainbow trout stocks are to be managed and provide guidance for the Board in developing future regulations.

### **Philosophy of the Plan**

The overriding philosophy of the Southwest Alaska Rainbow Trout Management Plan is one of conservative wild stock management. Conservative wild stock management does not necessarily preclude limited harvest of rainbow trout for food or trophies. However, maximum yield principles which emphasize harvest are ruled out. Additionally, under a philosophy that emphasizes wild trout management, mitigating losses of wild stocks through enhancement or stocking is not considered a desirable management alternative.

**Table 23.-Sport harvest of rainbow trout from waters of Southwest Alaska by fishery, 1977-1997.**

Drainage	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Eastern											
Ugashik	0	0	0	0	0	0	0	0	69 <sup>a</sup>	0 <sup>a</sup>	0
Egegik/Becharof	0	0	136	0	0	0	0	50 <sup>a</sup>	520 <sup>a</sup>	153 <sup>a</sup>	21 <sup>a</sup>
Naknek R.	586	371	954	1,705	2,184 <sup>b</sup>	975	2,398 <sup>b</sup>	2,881	1,561	2,425	1,167 <sup>b</sup>
Naknek L.	37	63	109	198	216	555	126	150	0 <sup>a</sup>	381	215
Bay of Islands							105	237	312	186 <sup>a</sup>	43
Brooks R.	173	181	227	224	227	42	136 <sup>b</sup>	50	69	79	86
Brooks L.											
American Cr.							0 <sup>a</sup>	25 <sup>a</sup>	17 <sup>a</sup>	0 <sup>a</sup>	64 <sup>a</sup>
King Salmon R.											
Kvichak R.	672	226	355	637	421	398	283	175	578	136	275
Copper R.	14	325	55	34	119	514	294	12 <sup>a</sup>	89 <sup>a</sup>	0 <sup>a</sup>	92 <sup>a</sup>
Alagnak R.					76	157	178	187	518	340	824
Newhalen R.	122	190	255	629	250	430	283	187	459	102	92
L Talarik Cr.	57	81	91	69	97	84	63	0 <sup>a</sup>	74	20 <sup>b</sup>	2 <sup>b</sup>
Lake Clark	0	0	0	0	0	0	0	25	44	0	92
Lake Iliamna							0 <sup>a</sup>	312 <sup>a</sup>	0 <sup>a</sup>	578	92
Kulik R.											
Tazimina R.											
Moraine Cr.											
Other	62	127	82	17	184	210	376	298	553	170	581
Subtotal	1,723	1,564	2,264	3,513	3,774	3,365	4,242	4,589	4,863	4,570	3,646

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**Table 23.-Page 2 of 4.**

Drainage	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	5-Year Average
Eastern											
Ugashik	0 <sup>a</sup>	52	22	0	0	0	19	0	0	0	4
Egegik/Becharof	0 <sup>a</sup>	20	22	32	32	18	95	12	12	53	38
Naknek R.	1,187 <sup>b</sup>	997 <sup>b</sup>	491	720	705	842	366	457	597	213	495
Naknek L.	418 <sup>a</sup>	62	44	160	63	18	43	40	12	73	37
Bay of Islands	237 <sup>a</sup>	177	109	240	222	10	0	0	62	67	28
Brooks R.	127	31	33	112	0	0	19	9	0	0	6
Brooks L.			240	80	40	9	114	90	0	0	43
American Cr.	0 <sup>a</sup>	21	22	32 <sup>a</sup>	0	0	113	0	109	0	44
King Salmon R.					0	0	0	0 <sup>a</sup>	71 <sup>a</sup>	0 <sup>a</sup>	14
Kvichak R.	91	50	254	37	356	269	191	12	59	23	111
Copper R.	18 <sup>a</sup>	30	42	56	0	0	0	0	0	0	0
Alagnak R.	18 <sup>a</sup>	343	423	243	111	312	74	107	24	221	148
Newhalen R.	73	81	53	693	55	89	175	208	83	214	154
L Talarik Cr.	36 <sup>a</sup>	4 <sup>b</sup>	0	37	16	0	0	0	0	0	0
Lake Clark	18 <sup>a</sup>	10	32	37	0	20	40	0	0	100	32
Lake Iliamna	18	91	53	75	24	122	103	155	24	40	89
Kulik R.					0	0	239	0	0	0	48
Tazimina R.					0	0	35	119 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	31
Moraine Cr.					0	0	0	0	0	0	0
Other	163	293	290	665	8	148	174	34	157	441	191
Subtotal	2,404	2,262	2,130	3,219	1,632	1,857	1,800	1,243	1,210	1,445	1,511

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**Table 23.-Page 3 of 4.**

Drainage	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Central											
Nushagak	31	108	191	387	670	252	346	599	87	263	92
Mulchatna	116	497	236	189	281	409	1,018	611	607	496	412
Agulowak											
Agulukpak											
Wood River L.	252	217	409	258	475	461	944	1,060	304	262	595
Tikchik L.	62	145	136	232	216	220	178	25	58	0 <sup>a</sup>	137 <sup>a</sup>
Koktuli R.											
Other					0	210	2,137	124	29	234	824
Subtotal	461	967	972	1,066	1,642	1,552	4,623	2,419	1,085	1,255	2,060
Western											
Togiak	102	54	82	215	130	168	336	32 <sup>b</sup>	0 <sup>b</sup>	58	46 <sup>b</sup>
Goodnews							52	104 <sup>a</sup>	451 <sup>a</sup>	0 <sup>a</sup>	111 <sup>a</sup>
Kanektok							640	312	156	70 <sup>b</sup>	132
Arolik											
Other							0	100	0	0	
Subtotal	102	54	82	215	130	168	1,028	548	607	128	289
Northwestern											
Aniak							336 <sup>a</sup>	52 <sup>a</sup>	0 <sup>a</sup>	221 <sup>a</sup>	56 <sup>a</sup>
Kisaralik											
Kwethluk											
Other							556	0	52	24	293
Subtotal							892	52	52	245	349
Eastern	1,723	1,564	2,264	3,513	3,774	3,365	4,242	4,589	4,863	4,570	3,646
Central	461	967	972	1,066	1,642	1,552	4,623	2,419	1,085	1,255	2,060
Western	102	54	82	215	130	168	1,028	548	607	128	289
Northwestern							892	52	52	245	349
Total	2,286	2,585	3,318	4,794	5,546	5,085	10,785	7,608	6,607	6,198	6,344

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**Table 23.-Page 4 of 4.**

Drainage	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	5-Year Average
Central											
Nushagak	272	135	55	200	190	122	230	172	325	77	185
Mulchatna	145	229	273	444	515	375	253	197	444	224	299
Agulowak										13 <sup>a</sup>	13
Agulukpak										0 <sup>a</sup>	0
Wood River L.	601	478	593	215	547	306	383	209	179	292	274
Tikchik L.	164	20	11	43	0	10	19	9	100	40 <sup>#</sup>	36
Koktuli R.					55	36	40	144 <sup>a</sup>	12	100 <sup>a</sup>	66
Other	36	182	220	339	55	28	98	280	48	170	125
Subtotal	1,218	1,044	1,152	1,241	1,362	877	1,023	1,011	1,108	916	987
Western											
Togiak	91 <sup>b</sup>	437	22	14	0	0	8	19	59	13	20
Goodnews	127 <sup>a</sup>	316	141 <sup>a</sup>	258	0	145	19	43	36	398	128
Kanektok	400	126	281	182	55	130	59	198	138	207	146
Arolik										40 <sup>a</sup>	40
Other	982	0	0	0	47	0	0	0	24	0	5
Subtotal	1,600	879	444	454	102	275	86	260	257	658	307
Northwestern											
Aniak	18 <sup>a</sup>	101	35	76	32	10	8	0	24	47	18
Kisaralik							124	9 <sup>a</sup>	215 <sup>a</sup>	195 <sup>a</sup>	136
Kwethluk					71	58	72	66 <sup>a</sup>	71 <sup>a</sup>	191 <sup>a</sup>	92
Other	0	214	18	243	222	84	9	113	71	87	73
Subtotal	18	315	53	319	325	152	213	188	381	520	291
Eastern	2,404	2,262	2,130	3,219	1,632	1,857	1,800	1,243	1,210	1,445	1,511
Central	1,218	1,044	1,152	1,241	1,362	877	1,023	1,011	1,108	916	987
Western	1,600	879	444	454	102	275	86	260	257	658	307
Northwestern	18	315	53	319	325	152	213	188	381	520	291
Total	5,240	4,500	3,779	5,233	3,421	3,161	3,122	2,702	2,956	3,539	3,096

Source: Mills 1977-1994, Howe et al. 1995-1998. Unless otherwise noted, these are published estimates for sites that garnered 12 or more responses in the Statewide Harvest Survey.

<sup>a</sup> Unpublished estimates from Statewide Harvest Survey for sites with less than 12 responses.

<sup>b</sup> Estimates from onsite creel survey.

**Table 24.-Sport catch of rainbow trout from the waters of Southwest Alaska by fishery, 1991-1997.**

Drainage	1991	1992	1993	1994	1995	1996	1997	5-Year Average
<b>Eastern</b>								
Ugashik	208	467	272	498	297	169	896	426
Egegik/Becharof	96	1,195	1,404	194	743	107	875	665
Naknek R.	13,863	14,850	16,393	10,113	14,501	10,678	11,045	12,546
Naknek L.	672	1,021	900	620	805	1,497	642	893
Bay of Islands	2,526	3,150	2,094	1,028	1,342	1,566	1,425	1,491
Brooks R.	4,573	9,634	13,575	12,301	6,091	7,189	9,873	9,806
Brooks L.	1,295	1,781	1,306	1,450	1,610	1,392	426	1,237
American Cr.	1,759 <sup>a</sup>	2,889	5,816	3,871	1,767	2,901	3,807	3,632
King Salmon R.		348	20	17	111 <sup>a</sup>	83 <sup>a</sup>	48 <sup>a</sup>	56
Kvichak R.	15,115	10,161	11,465	7,187	4,741	10,966	12,160	9,304
Copper R.	11,706	13,916	15,951	12,732	12,683	11,285	19,671	14,464
Alagnak R.	23,244	18,452	30,665	11,062	19,499	24,395	24,716	22,067
Newhalen R.	4,795	2,422	2,975	3,949	2,874	1,853	1,225	2,575
L Talarik Cr.	3,165	1,480	1,272	2,183	1,352	2,368	2,580	1,951
Lake Clark	862	760	173	309	642	109	973	441
Lake Iliamna	281	2,224	3,413	2,893	1,683	3,007	2,053	2,610
Kulik R.		2,201	7,225	5,373	3,717	7,253	8,795	6,473
Tazimina R.		1,172	1,035	996	2,027 <sup>a</sup>	1,237 <sup>a</sup>	351 <sup>a</sup>	1,129
Moraine Cr.		989	4,541	3,208	6,082	6,571	6,200	5,320
Other	30,502	8,653	13,135	15,443	9,482	18,040	18,447	14,909
Subtotal	114,662	97,765	133,630	95,427	92,049	112,666	126,208	111,996
<b>Central</b>								
Nushagak	8,750	5,407	8,966	6,530	5,808	9,425	8,890	7,924
Mulchatna	3,251	4,433	4,416	3,740	5,962	5,960	2,032	4,422
Agulowak							6,131 <sup>a</sup>	6,131
Agulukpak							6,911 <sup>a</sup>	6,911
Wood River L.	8,879	5,897	8,283	8,677	7,260	11,274	4,956	8,090
Tikchik L.	1,647	1,599	2,574	1,350	1,315	2,487	3,339	2,213
Koktuli R.		823	917	832	1,461 <sup>a</sup>	1,325	2,647 <sup>a</sup>	1,436
Other	1,934	499	1,250	3,693	2,931	2,624	4,002	2,900
Subtotal	24,461	18,658	26,406	24,822	24,737	33,095	38,908	29,594
<b>Western</b>								
Togiak	616	538	1,298	1,206	1,873	2,706	1,931	1,803
Goodnews	2,776	1,282	3,994	945	1,263	1,581	6,356	2,828
Kanektok	5,856	1,496	4,106	4,779	3,046	6,833	18,808	7,514
Arolik							1,667 <sup>a</sup>	1,667
Other	0	8	267	0	0	374	0	128
Subtotal	9,248	3,324	9,665	6,930	6,182	11,494	28,762	12,607
<b>Northwestern</b>								
Aniak	1,881	934	1,144	656	1,581	3,347	6,205	2,587
Kisaralik				1,226	1,153 <sup>a</sup>	1,379 <sup>a</sup>	1,265 <sup>a</sup>	1,256
Kwethluk		158	333	87 <sup>a</sup>	66 <sup>a</sup>	1,179 <sup>a</sup>	281 <sup>a</sup>	389
Other	790	1,211	2,279	312	3,423	1,685	672	1,674
Subtotal	2,671	2,303	3,756	2,281	6,223	7,590	8,423	5,655
Total	151,042	122,050	173,457	129,460	129,191	164,845	202,301	159,851

Source: Mills 1992-1994, Howe et al. 1995-1998. Unless otherwise noted, these are published estimates for sites that garnered 12 or more responses in the Statewide Harvest Survey.

<sup>a</sup> Unpublished estimates from Statewide Harvest Survey for sites with less than 12 responses.

Conservative wild stock management is predicated on both biological considerations and social concerns. Growth in the region's rainbow trout sport fisheries is inevitable, but by managing the area's wild rainbow trout stocks conservatively, the potential for serious long-term resource problems is minimized. From a social perspective, conservative wild stock management is consistent with the wishes and desires of most of the angling public presently using the resource.

The Southwest Alaska Rainbow Trout Management Plan contains policies which are intended to protect the biological integrity of the region's wild trout stocks and maximize their recreational benefit and economic potential. The policies provide management biologists within the Department of Fish and Game, Board of Fisheries members, and the public with clear policies to govern management of rainbow trout fisheries in the SWMA and guide the development of sport fishing regulations designed to implement these policies.

### **Policy I**

**Native rainbow trout populations will be managed to maintain historic size and age compositions and at stock levels sufficient such that stocking is not needed to enhance or supplement the wild population.**

This policy addresses the department's primary responsibility to ensure that resources are being managed on a sustained yield basis. Adherence to this policy ensures that management practices do not alter the historic size and age compositions of rainbow trout stocks within the management area. Additionally, this policy addresses the desire to maintain wild rainbow trout throughout the area and states that mitigating loss of wild stocks through enhancement or stocking is not a desirable management alternative.

Policy I is realized by managing rainbow trout stocks in a biologically sound manner under a conservative yield philosophy. Consistent with this philosophy, the general bag and possession limits for rainbow trout within the area do not exceed 2 per day of which only 1 may be greater than 20 inches. More restrictive limits may be applied to satisfy the goals associated with waters designated for special management or to address a biological problem.

### **Policy II**

**A diversity of sport fishing opportunities for wild rainbow trout should be provided through establishment of special management areas by regulation. Selection of areas for special management will be based on criteria to be adopted by the Board of Fisheries.**

Under this policy, special management areas are established to provide the sport fishing public with a variety of angling opportunities. Selection of waters for special management is based on criteria established by the Board of Fisheries, designed to ensure the most suitable waters are selected.

Policy II has been implemented by establishing special management areas that provide the sport fishing public with a range of desirable angling opportunities. In Southwest Alaska, special management may be designated as either Catch-and-Release or Trophy. In waters designated as Catch-and-Release or Trophy areas only unbaited, single-hook artificial lures may be used. Catch-and-Release or Trophy areas may further be designated as fly-fishing-only. In waters not



designated for special trout management, but during times when directed wild trout fisheries occur, the use of artificial lures (no single-hook restriction) can be considered depending on current harvest and effort levels.

Waters designated through regulation for special management are to be selected according to a process that addresses stock status, location, historical use patterns, accessibility, aesthetics, geographical distribution of angling opportunities, and the economic return in terms of commerce generated and jobs created. Each candidate water is ranked according to 11 criteria to determine its suitability for special management. These criteria include:

1. **STOCK STATUS.** To be considered for Catch-and-Release or Trophy designation, a candidate water must meet the biological objectives of conservative yield, which call for the maintenance of the historical size and age composition and stock levels of the rainbow trout population(s). Historical fisheries statistics are used to make this determination. Any candidate water that meets the conservative yield objectives is considered by the Board against criteria 11.
2. **HISTORY OF SPECIAL MANAGEMENT.** This is a subjective category that considers the public's perception of the history of rainbow trout fishing in the candidate water. It is assumed that a water which people associate with having provided "quality" trout fishing can more easily be managed for that purpose than a water with no history of fine trout fishing.
3. **PROXIMITY TO LOCAL COMMUNITY.** A water is preferred if it is not located near enough to a permanent community to be commonly used and/or visited by local residents. The intent of this criteria is to avoid conflict with traditional consumptive use patterns of local residents.
4. **LEGAL ACCESS.** This refers to public ownership of the adjacent lands or the water being classified as navigable. A water with over 50% of its banks publicly owned, or a navigable designation, would be preferred.
5. **OVERLAP WITH FRESHWATER NET FISHERIES.** Special management areas should be seasonally and/or spatially segregated from subsistence and freshwater commercial net fisheries.
6. **ABUNDANCE AND SIZE OF RAINBOW TROUT.** This refers to the number and average size of the catchable rainbow trout seasonally present in a candidate water. Waters with relatively high numbers of rainbow trout and waters with uniquely large rainbow trout would be favored for special management.
7. **WATER CHARACTERISTICS.** This refers to the habitat characteristics and appearances of a water. A stream with clear water and riffle-pool configuration with a gravel bottom would be preferred.
8. **CLEAR GEOGRAPHICAL BOUNDARIES.** This refers to the angling public's ability to clearly distinguish the legal regulatory boundary of a candidate special management area.
9. **RELATIVE IMPORTANCE OF RAINBOW FISHERY TO SPORT FISHING INDUSTRY.** A candidate water of high economic value to the sport fishing industry would be favored as an area for special management.

10. GEOGRAPHICAL DISTRIBUTION OF SPECIAL MANAGEMENT WATERS. The designation of a candidate water for special trout management should take into consideration its proximity to other special management waters and the availability of alternative locations not designated for special management.
11. RESEARCH, EDUCATIONAL, OR UNIQUE CONSIDERATIONS. Where necessary, waters may be designated for special management for research or educational reasons. This category recognizes unusual situations which would further diversify angling opportunity, such as the potential for a catch-and-release water near a rural community if local support is expressed.

### **Policy III**

**Management strategies should be consistent with the prudent economic development of the state's recreational sport fishing industry while at the same time acknowledging the intrinsic value of this fishery resource to the people of Alaska.**

This policy acknowledges that Southwest Alaska's wild rainbow trout are of vital importance to the state's recreational industry and that wise development of commercial recreation is to the economic benefit of the region and the state. Management practices that maintain or enhance the marketability of high quality recreation are favored under this policy.

Consideration of the economic impact to the recreational industry, of both the local area and the state in general, should be given in all regulatory actions regarding rainbow trout within the management area. Whenever possible, emergency orders and regulations should be structured to foster the prudent economic development of the industry.

To implement Policy III, department managers are asked to recognize that due to the remoteness and logistical difficulty of travel in southwestern Alaska, fishery closures may severely impact angling opportunity and the related recreational industry.

To assist the department with implementing Policy III, the Board of Fisheries has expanded the department's emergency order authority to include not only the ability to effect time and area closures, but to also adjust bag limits and methods and means that if employed inseason could avoid disruptive closures.

### **Plan Implementation**

Regulations based on the Southwest Alaska Rainbow Trout Management Plan were adopted by the Alaska Board of Fisheries in February of 1990. These regulations were designed to implement the three management policies contained in the rainbow trout management plan. Specifically, the Board:

- Expanded the Wild Trout Zone from the Iliamna drainage to include the drainages of Bristol Bay and Kuskokwim Bay and the Kuskokwim River from Aniak River downstream.
- Established eight catch-and-release areas (Figure 15).
- Established six fly-fishing/catch-and-release-only areas (Figure 16).

- Established 11 unbaited single-hook artificial lure only areas to protect rainbow trout stocks (Figure 17).

Adoption of regulations implementing the management policies contained in this plan was not expected to be a one-time effort. Rather, the implementation of these policies is a long-term process, using the policies contained in this plan as the framework for development of a very important and unique resource.

## **LOWER TALARIK CREEK**

### **Fishery Description**

Lower Talarik Creek, located at the northwest corner of Lake Iliamna, is renowned for its high quality rainbow trout sport fishery. The creek is relatively small and most anglers only fish along the first 2 miles above its entrance into Lake Iliamna. The large fish, for which Lower Talarik Creek is so famous, enter the creek from Iliamna Lake to feed on salmon spawn and salmon carcasses in the fall. The sport fishery takes advantage of this migration and is most active from mid-August until freeze-up in late September or October. Most anglers fishing Lower Talarik Creek are guided, nonresidents who make daily fly-in trips from the many lodges operating in the Lake Iliamna area. From 10 to 20 anglers can be accommodated at any given time in the lower portion of the creek that is commonly fished.

### **Historical Performance**

Fisheries managers first estimated angler effort and harvest on Lower Talarik Creek rainbow trout with onsite creel surveys from 1970 through 1976 (Table 25). Annual harvest ranged from a high of 433 fish in 1971 to 73 fish in 1974. Since 1977, effort has been estimated from the Statewide Harvest Survey and has been measured in angler-days (Mills 1979-1994, Howe et al. 1995-1999). Effort on Lower Talarik Creek appears to be relatively constant at 600 to 900 angler-days per year with a few excursions outside this range (Table 6). Onsite creel surveys conducted during the fall fisheries of 1989, 1990, 1991, and 1993 through 1997 found effort has been at the upper range of, but not significantly different from, the levels observed in the 1970s (Table 25). Note the small estimates of catch and effort in 1997 are due to the short duration of the survey.

Harvests of Lower Talarik creek rainbow trout have been less than 100 fish annually since 1977 and were virtually nonexistent after 1985 (Table 23). Lower Talarik Creek became a catch-and-release only fishery by regulation in 1990.

### **Management**

Lower Talarik Creek is managed as a special management area, restricted to unbaited artificial fly tackle and catch-and-release of rainbow trout. A spawning season closure provides protection during this critical season. Sport effort, catch, and harvest are estimated via the statewide harvest survey. Subsistence harvests are not well monitored and are the responsibility of the Commercial Fisheries Division. Onsite surveys yield detailed estimates of angler use and success. Biological information and demographic information are also collected. Significant

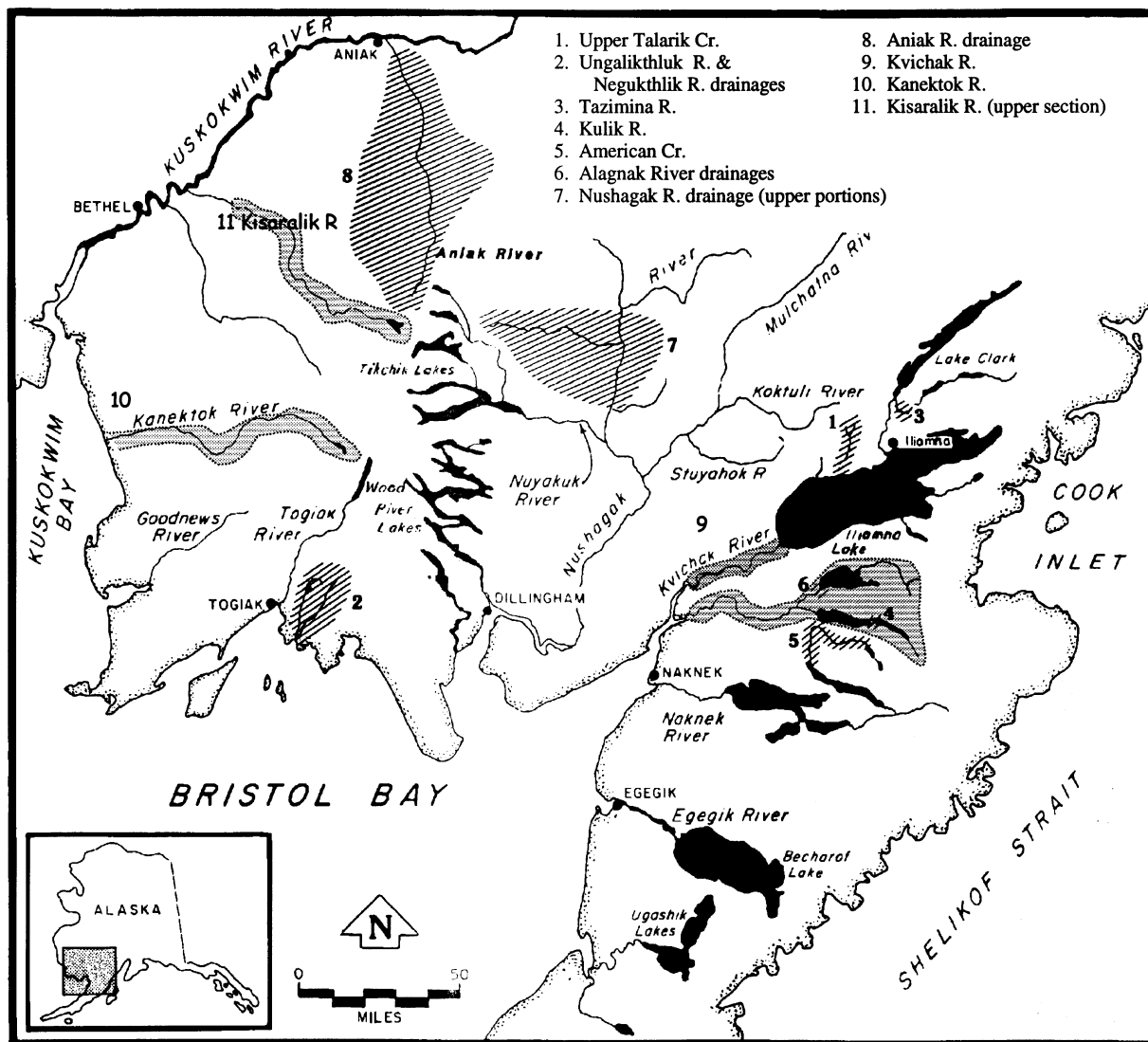


Figure 15.-Catch-and-release special management areas.

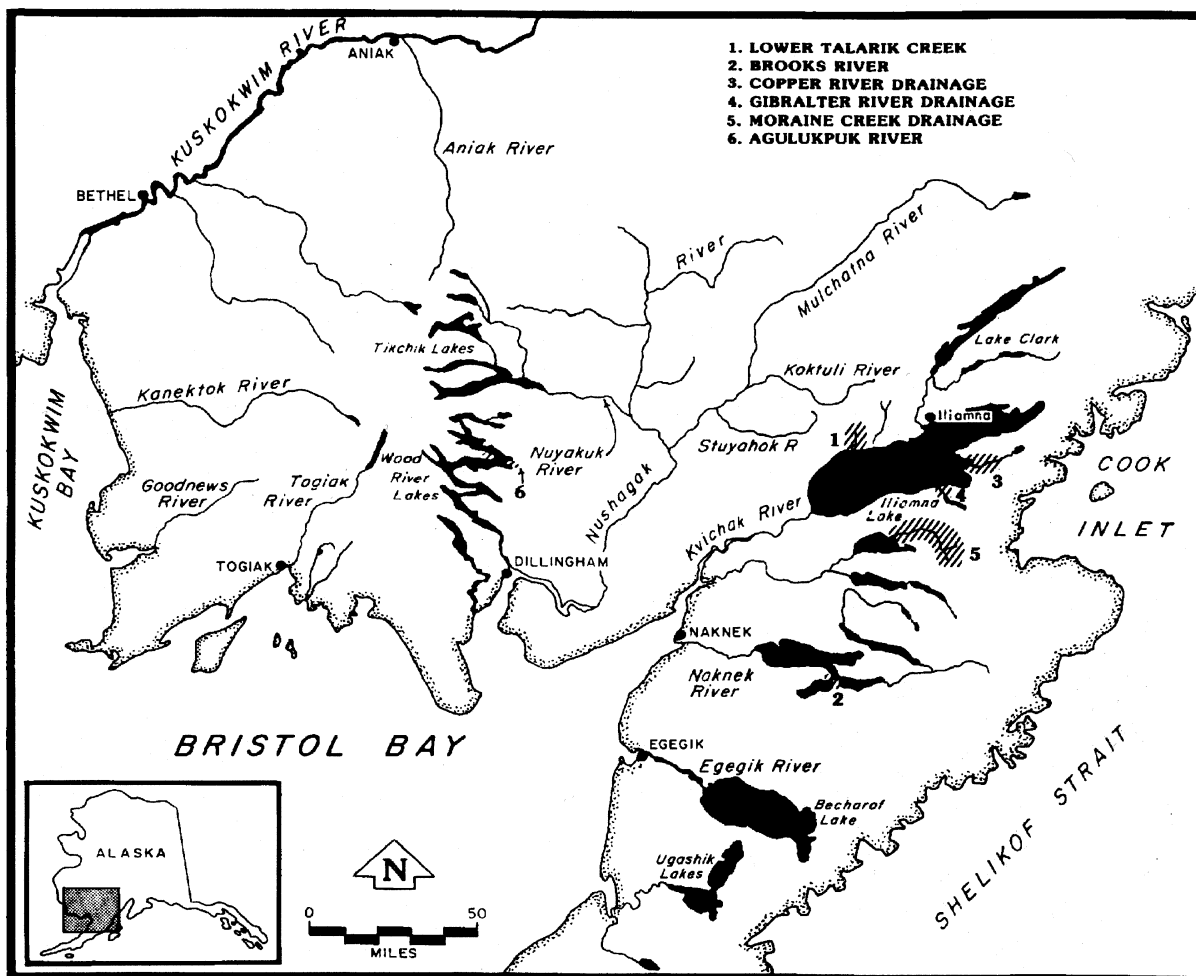


Figure 16.-Fly fishing catch-and-release special management areas.

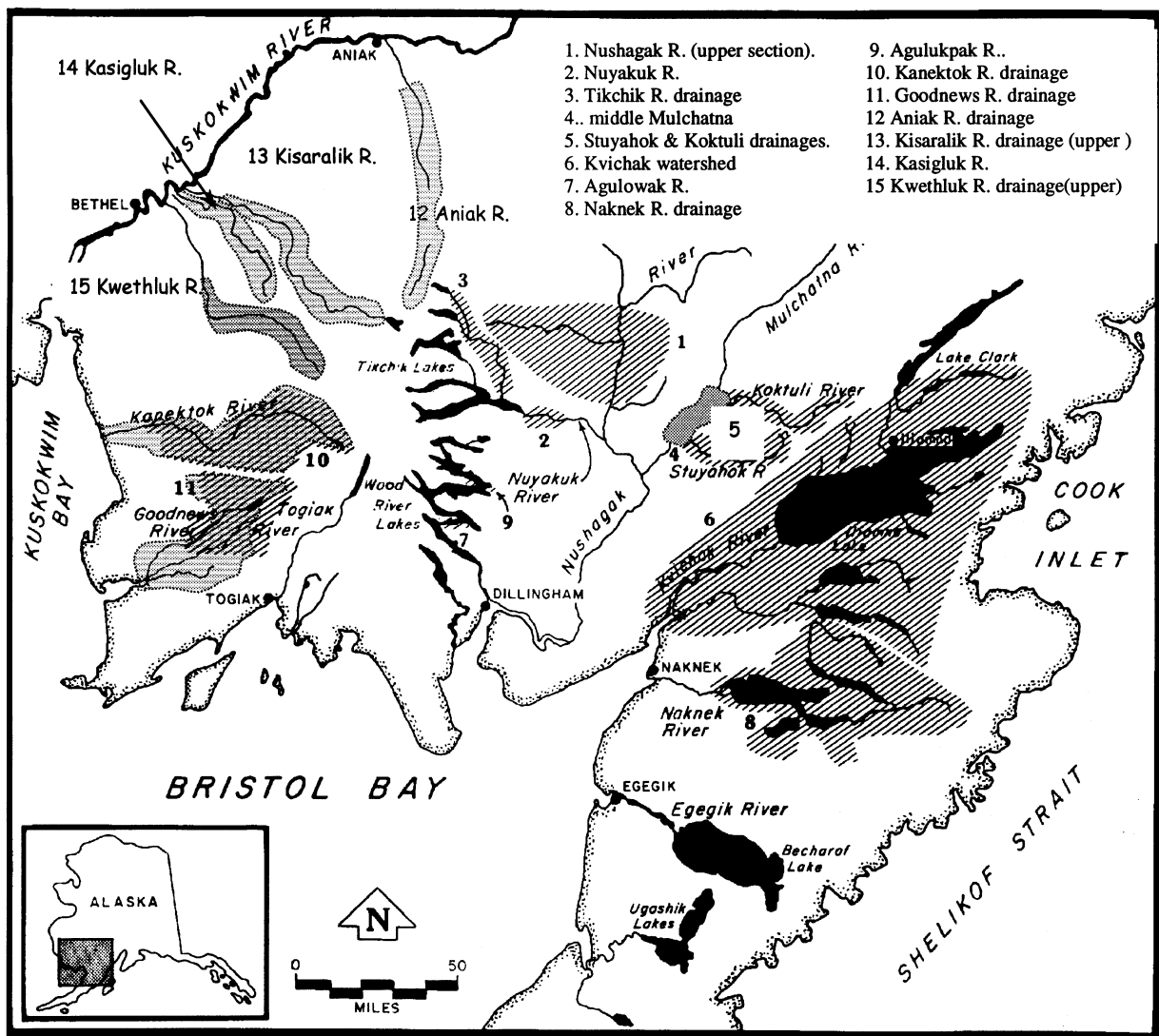


Figure 17.-Unbaited single-hook artificial lure special management areas.

**Table 25.-Angler effort, catch, harvest, retention rate, and catch per angler-hour for rainbow trout, Lower Talarik Creek, estimated from onsite creel surveys, 1970-1976, 1986, 1989-1991, 1993-1998.**

Year	Angler-Hours	Catch	Harvest <sup>a</sup>	Percent Retained <sup>a</sup>	Survey Dates
1970	1,315	600	119	20%	8/26-10/11
1971	2,604	2,300	433	19%	6/8-9/30
1972	1,718	834	141	17%	6/8-9/30
1973	1,376	780	113	14%	6/8-9/30
1974	1,037	498	73	15%	6/8-9/30
1975	1,048	1,648	127	8%	6/8-9/30
1976	438	843	92	11%	6/8-6/15; 9/12-9/23
1986	2,063	2,389	16	1%	6/8-6/15; 8/15-10/9
1989	1,893	2,844	4	1%	8/22-9/22
1990	2,086	2,910	0		9/1-9/27
1991	1,729	2,363	0		8/30-9/25
1993	1,080	699	0		9/10-9/20
1994	2,462	3,273	0		9/2-9/29
1995	2,496	3,200	0		9/1-9/29
1996	1,930	1,655	0		9/3-9/30
1997	1,210	1,794	0		9/1-9/15
1998	2,596	1,698	0		8/31-9/21

Source: Russell 1977, Minard 1990, Minard et al. 1992, Dye *Unpublished*, Schwanke *Unpublished* a.

<sup>a</sup> Lower Talarik Creek became a catch-and-release fishery in 1990.

stock assessment and creel survey results are reported by Russell 1977, Minard 1990, Minard et al. 1992, Dye *Unpublished*, Schwanke *Unpublished a*.

Lower Talarik Creek's small size, accessibility, and abundant large rainbow trout garnered early regulatory attention. A synopsis of significant regulation changes follows:

- 1965. Spawning season closure imposed on Lower Talarik Creek. Lower Talarik Creek closed to all fishing from April 10 to June 8.
- 1968. Lower Talarik Creek was included in the "Bristol Bay Trophy Fish Area."
- 1969. Bag and possession limits reduced to 5 trout, only 1 over 20 inches in length. Helicopter access was forbidden, single hooks were required on tackle.
- 1974. The use of bait was prohibited during the summer months.
- 1977. Trophy Fish Area renamed the Bristol Bay Wild Trout Area, retaining the regulations accumulated since 1965.
- 1981. Gear was limited to single-hook artificial flies from June through October.
- 1984. Reduced the bag and possession limit to 2 rainbow trout, 1 over 20 inches.
- 1985. Reduced the bag limit to 1 rainbow trout during the summer.
- 1990. Adopted the Southwest Alaska Rainbow Trout Management Plan. Lower Talarik Creek was designated as a special management area, to be managed under fly-fishing-only, catch-and-release restrictions.

The ownership and use of the lands around Lower Talarik Creek have been of particular concern to department management. Although the state owns much of the land in the vicinity of Lower Talarik Creek, there have been Native Allotment claims proposed for some adjacent lands that raised concerns for long-standing public access to this important fishery. The lands under state management are also deserving of attention as Department of Natural Resources, Division of Lands, considers the best blend of land uses for the area. Resolving land status issues and preserving public access to the recreational fishery at Lower Talarik Creek are a high priority for the department.

A Native Allotment claim that could have jeopardized public access to the Lower Talarik Creek fishery has recently been resolved. The Nature Conservancy of Alaska acquired title to land adjacent to the popular fishing sites along Lower Talarik Creek through a special agreement with the claimant. This land will be transferred to the State of Alaska for long-term management as a special use area under the terms of a December 1995 cooperative management agreement between The Nature Conservancy, ADF&G, and the Department of Natural Resources. Beginning in July 1998 the Department of Natural Resources was taking public comment in preparation for establishing the Lower Talarik Creek Special Use Area. When established, there will be some modest restrictions for guides and their clients and for private anglers and campers during the period of August through October. The restrictions will be designed to maintain the historic use patterns in this fishery. The Alaska Department of Fish and Game supports the establishment of this Special Use Area and has made the collection of data from this fishery a priority.



## **Management Objectives**

The Lower Talarik Creek rainbow trout fishery is managed to maintain historical age and size composition and a diversity of angling opportunity by maintaining the special management designation with fly-fishing-only, catch-and-release.

### **1998 Season**

The 1998 fall creel survey covered the 3-week period of August 31 to September 21 (Table 25). Results suggest sport fishing effort (2,596 angler-hours) was above levels observed for the recent 5 years (Table 25). The catch of 1,698 rainbow trout appears to be good. Size composition of the catchable populations appeared to shift to fish larger than those sampled in the mid 1980s.

### **1999 Outlook**

Sport fishing opportunity at Lower Talarik Creek is expected to slow during the first weeks of the season in June. By late August until freeze-up in early October fishing should be excellent. The number of large fish (in excess of 8 pounds) caught each season appears to be stable, and overall catch rates are high for experienced anglers. The Division of Sport Fish will continue a fishery monitoring program using volunteer staff. No inseason changes to the regulations are anticipated for the 1999 season.

## **NAKNEK RIVER**

### **Fishery Description**

The Naknek River supports the largest rainbow trout sport fishery (based on harvest level) in the SWMA. The first significant recreational use of Naknek River stocks occurred in the mid-1950s when two recreational camps were constructed by the military for use by military personnel. The camps, one located at the outlet of Naknek Lake (Lake Camp) and one at the lower reach of the rapids (Rapids Camp) provided a base for significant sport fishing opportunity until 1974. Within that time period, civilians discovered the bountiful resources and effort continued to grow. By the mid 1980s there were approximately 12 guiding services working the river regularly, with others less frequently. Boat rental and lodging services, available in King Salmon, provided the necessary support needed by the unguided angler.

The rainbow trout sport fishery takes place in the upper reach of the river upstream from Rapids Camp to the outlet of Naknek Lake and has three periods of activity: March to April 10, June 8 to June 30, and August 15 to freeze-up in October.

### **Historical Performance**

Estimates of harvest for rainbow trout from the Naknek River were first available in 1977 from the statewide harvest and participation survey (Table 23) (Mills 1979-1994, Howe et al. 1995-1999). Annual harvest increased from about 600 rainbow trout in 1977 to a peak of 2,900 fish in 1984. Since 1984, harvest of Naknek River rainbow trout has declined to levels first observed in 1977 (Table 23). Harvest alone, however, is not a reliable indicator of fishery performance for rainbow trout fisheries in Southwest Alaska. The combination of effort, catch, harvest, and fish size information derived from onsite surveys provides a much more comprehensive evaluation of fishery performance. From 1978 through 1989, the Division of Sport Fish conducted fall fishery surveys in the upper reach of the Naknek River (Table 26). These data demonstrated that a clear and significant increase in effort and catch occurring over the 10-year study period, along

**Table 26.-Effort, harvest, catch, and catch rate statistics for anglers fishing the upper Naknek River during the period August 15 through October 15, 1978, 1981, 1983, 1984, 1987, 1988, and 1989. Length statistics of harvested rainbow trout during these years are also presented.**

Year	Effort	Catch	Harvest	Proportion Retained	Length (mm)		
	Angler-Hours				Mean	SE	SS <sup>a</sup>
1978	1,896	847	248	0.29	484	20.2	55
1981	3,025	4,322	860	0.20	444	6.2	218
1983	6,755	4,182	1,452	0.35	430	5.7	135
1984	4,611	3,092	570	0.18	466	9.02	192
1987	4,450	4,779	434	0.09	423	9.3	81
1988	6,246	3,147	566	0.18	377	10.6	99
1989	7,249	7,120	407	0.06	430	15.1	72

Source: Dunaway 1990, Minard 1987, 1989.

<sup>a</sup> Sample Size

with a significant drop in the proportion of retained fish (Minard 1989a). Somewhat alarming was a declining trend in average size of the spawning stock and catchable population. It was apparent from the combination of creel survey and biological data available that the sport fishery was overharvesting the larger, older segment of the population. Comments received from the angling public were consistent with the department's findings.

Corrective actions in the form of reduced limits as well as size limits and method restrictions were proposed to the Board and adopted in 1990 (Minard 1990). Follow-up assessment work in the spring of 1993 suggested the declining size composition had been arrested, and fall work found early indications of improved recruitment (Dunaway *Unpublished*). In 1995, sampling of the fall population discovered the size composition of the catchable population has been restored to the proportions observed in the early 1980s (Fair *Unpublished*). Recent comments from the public and anglers familiar with the fishery support the department conclusions and generally indicate the population is in very good condition.

### Management

Sport effort, catch, and harvest are estimated via the statewide harvest, catch, and participation surveys (Mills 1979-1994, Howe et al. 1995-1999). Subsistence harvests, considered slight but not well monitored, are the responsibility of the Commercial Fisheries Division. Onsite surveys

yield detailed estimates of angler use and success as well as data on angler demographics and biological samples from the catch. Significant stock assessment and creel survey results have been reported by Berger and Gwartney (1986), Minard 1989a, Minard 1990, in 1993 by Dunaway (*Unpublished*), and in 1995 by Fair (*Unpublished*).

There is a long history of special regulations for Naknek River rainbow trout stocks dating back to statehood. Seasons, limits, and gear restrictions were initially liberal. However, as effort increased, reports of declining catch rates and smaller size of the catchable population increased. Department studies conducted in the late 1980s verified the suspected decline. Available data supported by public opinion indicate the stocks have recovered. Current regulations (ADF&G 1998b) still reflect the remedial actions adopted in 1990 and allow for an open water harvest of 1 rainbow trout per day less than 18 inches in length and a winter season harvest of 5 per day less than 18 inches in length. The spawning season closure is still in effect from April 10 to June 7, and only single-hook artificial lures may be used in the area above Rapids Camp.

Growing interest in the spring fishery that occurs prior to April 9 has resulted in public requests for more intensive management during this time period. Some anglers support managing portions of the river for quality of experience by advocating restrictions to angler access. Other management suggestions include managing for a particular size composition in the sport catch with emphasis on providing very large fish. Yet other anglers remain convinced that growth of the rainbow trout fishery on the Naknek River requires vigilance and possibly additional restrictions just to maintain the biological integrity of the population. Regardless of the perspective, it appears clear that the angling public is extremely interested in maintaining and enhancing this fishery. The department is likely to see a growing demand for more intensive management strategies of this and other rainbow trout fisheries.

During the fall 1997 Board of Fisheries meeting in Naknek, the Board formed a committee to develop a rainbow trout management plan for the Naknek River. A community meeting was held in April and two Board members attended. In addition, the Board members spent some time observing the spring fishery and getting comments from the participants. The department has summarized all relevant data available for Naknek rainbow trout and provided this material to the local advisory committee. The department also provided some examples of management plans as well as suggested some points to include in the eventual plan.

### **Management Objectives**

Naknek River rainbow trout stocks are being managed to restore and maintain the historical age and size composition reported in the early 1980s. Research projects on rainbow trout populations throughout the SWMA are beginning to provide the department with new understanding and may soon allow more precise and quantitative definitions of management objectives for this species.

### **1998 Season**

No field data were collected concerning this fishery in 1998. Reports from anglers generally indicated a stable or improving fishery. A few complained the fishery was still depressed. Interest in this fishery remains high, and though several proposals for regulation changes were submitted for the 1997 Board meeting, little occurred on the management plan after the April visit by the Board of Fisheries committee.

## **1999 Outlook**

Sport fishing for rainbow trout is expected to be good to excellent all season. The best fishing can be expected in mid June at the outlet of the lake and in the Rapids area. During this period, trout are drawn to these areas to feed on salmon smolt as they migrate to sea. Fishing in early July with dry flies will be good, and then after a lull in late July, fishing will improve in early August as the trout move into salmon spawning areas to feed on eggs and carcasses. The best fishing for large trout will occur from late September until freeze-up in October. No inseason adjustments to the fishery are anticipated in 1999.

## **ALAGNAK (BRANCH) RIVER**

### **Fishery Description**

The Alagnak River, frequently referred to locally as the Branch River, is located in the eastern portion of the management area and flows into the Kvichak River approximately 40 miles north of King Salmon. The Alagnak River arises in Katmai National Park and Preserve and has been designated a Wild and Scenic River.

Two large lakes, Kukaklek and Nonvianuk, feed this drainage. Kukaklek Lake is drained by the Alagnak River while the Nonvianuk River flows 11 miles from Nonvianuk Lake to join the Alagnak River from the south. The Nonvianuk River is a wide, relatively gently flowing river (class 2 or less) that provides the most convenient float trip access to the upper drainage. The upper Alagnak River is characterized by a narrow canyon and class 2+ rapids that provide a more rigorous boating experience. Below its confluence with the Nonvianuk River, the Alagnak is slower and easily navigated. At the proper water levels both rivers can be navigated their entire lengths with power boats. The water is clear throughout its length, though the lower 20 miles are colored lightly from silt and bog-stained runoff.

In the lower portion of the drainage anglers pursue chinook, coho and sockeye salmon. In the upper reaches, rainbow trout are the big attraction, with some lake trout at headwater lakes and char and grayling in the river adding diversity to the angling experience. The fisheries are accessed with power boats, particularly the lower 1/2 to 2/3 of the river, while float trips are the most common access in the upper reaches. Seven lodges are based along the river, four in the lower 20 miles, one lodge near the outlet of each of the headwater lakes and one more is located along the midpoint of the river. Many other lodges from the surrounding area fly clients to the river for day-trip fishing.

The easy access and abundant fish populations of the Alagnak River are major reasons the popularity of this river has grown so quickly. Rainbow trout from the Alagnak River drainage are similar to fish of the nearby Kvichak and Naknek drainages and are known for their abundance and large size.

### **Historical Performance**

In terms of angler effort, the Alagnak River is the second most popular fishing destination in southwest Alaska after the Naknek River. Estimates of effort and harvest for rainbow trout from the Alagnak River were first available in 1981 from the statewide harvest and participation survey (Tables 6 and 23). During the seasons of 1981 through 1991 effort was low to moderate and annual estimates ranged from 1,182 to 7,628 angler-days per year. Average annual effort increased suddenly to 12,323 angler-days in 1992 and has remained consistently high ever since. Effort currently averages 12,362 angler-days for the 1993-1997 seasons (Table 3). Annual

rainbow trout harvest increased from less than 200 fish per year prior to 1985 to a peak of 824 fish in 1987. Since 1988, harvest of Alagnak River rainbow trout has declined to levels first observed in the early 1980s (Table 3). From 1993 to 1997 the annual catch (fish released plus fish kept) has averaged over 20,000 rainbow trout per year (Table 3). At this level, the Alagnak River has become the most popular rainbow trout fishery in southwest Alaska. Annual harvest of rainbow trout averaged 148 per year from 1993-1997 (Table 3), and is likely selective for large fish.

Harvest alone is not a reliable indicator of fishery performance for rainbow trout fisheries in Southwest Alaska. During the period 1978 through 1989, the Division of Sport Fish conducted fall fishery surveys for seven seasons in the nearby Naknek River. Over the study, data demonstrated a clear and significant increase in effort and catch, yet a significant drop in the proportion of fish kept or harvested (Dunaway 1990c). Similar observations have been made in other fisheries throughout the SWMA. The department has interpreted the phenomenon as an acceptance of catch-and-release as an ethic among anglers, particularly for rainbow trout, and we assume the declining harvest on the Alagnak River can be explained in part by this shift in attitude.

## **Management**

Sport effort, catch, and harvest are estimated via the statewide harvest, catch, and participation surveys (Mills 1979-1994, Howe et al. 1995-1999). Subsistence harvests, considered slight but not well monitored, are the responsibility of the Commercial Fisheries Division. Onsite surveys yield detailed estimates of angler use and success as well as data on angler demographics and biological samples from the catch. Significant stock assessment and creel survey results, focused on the lower river salmon fisheries but containing some rainbow trout data, have been collected and reported by Brookover (1989a) and by Dunaway (1990a and 1994). Surveys of the spring sport fisheries were conducted jointly with the NPS and department in 1996 at the outlet of Nonvianuk Lake and at the outlet of Kukaklek Lake in 1997 (Jaenicke 1998a and 1998b). In 1997 the Biological Research Division of the U. S. Geological Survey, in cooperation with the NPS, began a rainbow trout population study on the Alagnak and Nonvianuk rivers (Eric Knudsen, USGS-BRD, Anchorage, personal communication). The study was continued through 1998 but was plagued by failures of the batteries in some radio tags (Troy Hamon, Fisheries Biologist, Katmai NP, personal communication). Results of this study were not available at the time this report was written.

Located between the Kvichak and Naknek drainages, management of the Alagnak and Nonvianuk rainbow trout fisheries has been much the same as outlined for those adjacent fisheries. For quite some time the sport fishing season has featured a spring spawning closure from April 10 through June 7, and single-hook artificial lure only restrictions. During the open water season, regulations have allowed the retention of 1 rainbow trout per day, no size limit.

Because it is comparatively difficult to access, the Alagnak fishery only lately received angling effort in levels capable of affecting the fish populations. Starting about 1993, coincident with increased fishing effort, department staff began receiving complaints that the rainbow trout stocks in the Alagnak were declining. Data for the Alagnak River rainbow trout fishery prior to 1996 were sparse. Results from a sampling trip in 1995 suggested that the size composition and age structure may be depressed. In 1996 a joint ADF&G and National Park Service creel survey

was conducted at the outlet of Nonvianuk Lake, in the upper Alagnak River drainage (Jaenicke 1998a). Thirty-four anglers were asked to compare their experience in 1996 to experiences in the past with regard to catch rate and average size of the catchable population (Table 4). Many anglers felt both catch rate and size composition had diminished (Jaenicke *Unpublished*). In addition to the survey, NPS staff also collected size and age samples from the catchable population. Results showed the size distribution to be skewed toward small fish, and age composition to be primarily age-4 and -5 fish.

As a result of the 1996 work, an emergency order closing the Alagnak and Nonvianuk rivers to the sport harvest of rainbow trout was issued effective July 1, 1996, and was reissued prior to the June 8 opening in 1997.

In the spring of 1997 another creel survey was conducted at the outlet of Kukaklek Lake (Jaenicke 1998b and *Unpublished*). The size composition information collected throughout the drainage does not suggest as depressed a condition as shown in 1996. These studies show the following points:

1. Harvests of rainbow trout are estimated to be small, but are likely selective for large fish.
2. Many anglers felt the catch rate and size composition have diminished over time.

In addition to the lake outlet creel surveys on the upper Nonvianuk and Alagnak rivers, a population assessment study was initiated in 1997. The Biological Research Division of the U. S. Geological Survey, in cooperation with the NPS, began a rainbow trout population study that was designed to include the entire length of the two rivers (Eric Knudsen, USGS-BRD, Anchorage, personal communication). Results of this study are not likely to be available until the spring of 2000, but are expected to provide insights on the populations (Jennifer Nielsen, USGS-BRD, Anchorage, personal communication). Due to design problems, a valid estimate of population abundance may not be possible.

During their 1997 fall meeting, the Alaska Board of Fisheries created a catch-and-release special management area for Alagnak River rainbow trout. From June 8 through October 31 rainbow trout in the Alagnak and Nonvianuk rivers may not be possessed or retained. From November 1 through April 9 fishermen may retain 5 rainbow trout less than 18 inches in length. The new regulations were generally well received by anglers and are expected to provide a measure of protection to this population until better information becomes available.

### **Management Objectives**

The Alagnak River rainbow trout fishery is managed to maintain historical age and size composition.

### **1998 Season**

The 1998 fishery produced mixed but generally good reports of angler success. Some anglers reported excellent success, leaving one to wonder what is going on with this population. Comments from Eric Knudsen (USGS-BRD, Anchorage) indicate that the USGS project was not expected to show a population in imminent danger or decline. Water levels and temperatures and other environmental factors were much more normal during 1998, possibly contributing to the more “normal” sport fishery this season.

## **1999 Outlook**

Spring angling at the outlets of Kukaklek and Nonvianuk lakes should be average in 1999. Fall fishing in the braids and along salmon spawning areas is likely to be average as well. With a stronger sockeye salmon run expected, the rainbow trout's food supply should be better than in the previous two seasons.

## **AGULOWAK RIVER**

### **Fishery Description**

The Agulowak River is located north of Dillingham and just inside the southern boundary of the Wood-Tikchik State Park. Though known primarily for its abundant Arctic char stocks, it is also one of the two most popular rainbow trout fisheries in the Central section. As with other fisheries in the SWMA, development of the recreational fishery grew gradually from the 1950s, saw its first commercial lodge facility by the early 1960s, then grew significantly beginning in the early 1970s as more lodges were built and Alaskan fly-out fishing became popular. A unique characteristic of the Agulowak River is the relative ease of access from Bristol Bay's most populous city, Dillingham, and the village of Aleknagik. As a consequence, the Agulowak River supports a much greater rate of local use than more remote waters within the section.

The rainbow trout sport fishery takes place throughout the open water period along the entire 3-mile length of the river. Favored periods for catching rainbow trout are early summer before the sockeye and pink salmon runs begin, and after mid-August when the trout feed on salmon eggs and carcasses. There may be limited fishing through the ice at the head of the river in winter.

### **Historical Performance**

The Agulowak River has not received the level of regulatory attention given to fisheries in the Eastern section, and little historical information is available. Informal investigations of the sport fishery in 1975, 1976, and 1977 suggested increasing sport fishing effort resulting in increased catches and harvests of rainbow trout. A formal creel survey program conducted on the Agulowak River in 1986, 1987, and 1988 (Minard 1989b) estimated angler effort to range from 3,582 to 6,397 angler-hours per year; estimated annual catches of 1,784 to 2,666 rainbow trout; and estimated harvests to range from 72 to 328 rainbow trout per year (Table 27). Analysis of the size and age data collected during the surveys suggested that the size composition of rainbow trout in the Agulowak River was shifting to smaller fish, indicating the sport fishery may have been harvesting too many older aged fish (Minard 1990). These results prompted more restrictive harvest regulations and the fishery is presently in a state of recovery.

### **Management**

Sport effort, catch, and harvest are estimated via the statewide harvest, catch, and participation survey (Mills 1979-1994, Howe et al. 1995-1999). Subsistence harvests, considered slight but not well monitored, are the responsibility of the Commercial Fisheries Division. Onsite surveys yield detailed estimates of angler use and success.

**Table 27.-Estimates of effort, catch, and harvest of rainbow trout from the sport fisheries in the Agulowak and Agulukpak rivers, 1986-1989, 1992 and 1996.**

Year	Location	Survey Dates	Effort		Catch		Harvest	
			(Angler-hrs.)	SE	Fish	SE	Fish	SE
1986	Agulowak	6/19-8/23	3,732	533.5	1,784	266	84	15
1987	Agulowak	6/6-9/7	6,397	501.1	2,584	611	328	113
1988	Agulowak	6/6-9/6	3,582	360.9	2,666	618	72	31
1989	Agulowak	6/11-9/1	4,009	303.6	1,488	1,193	40	102
1986	Agulukpak	6/29-8/23	1,826	208.8	1,322	151	0	0
1987	Agulukpak	6/17-9/16	4,265	57.5	3,692	25	2	0
1988	Agulukpak	6/14-9/16	3,684	45.9	2,884	48	0	0
1989	Agulukpak	6/25-9/24	4,010	29.9	2,115	187	0	0
1992	Agulukpak	8/1-9/22	2,759	53.6	1,862	72	0	0
1996	Agulukpak	6/23-9/22	6,301	103.0	5,320	113	5	0

Source: Minard 1989b, Dunaway 1993b, Rogan and Jaenicke 1997.

Biological information and demographic information were also collected. Significant stock assessment and creel survey results have been reported by Minard (1989b and 1990), and Dunaway (1993).

The following is a regulatory chronology for the Agulowak River:

- 1959. Year-round season and a bag limit of 15 fish per day, only 3 over 20 inches.
- 1962. Ten trout per day, only 2 over 20 inches.
- 1972. Five rainbow trout, 1 over 20 inches.
- 1984. Season was split with a June 8 to October 31 bag limit of 2 rainbow trout, 1 over 20 inches per day, and a November 1 through June 7 limit of 5 fish per day, 1 over 20 inches long.



- 1990. Implementation of the Southwest Alaska Rainbow Trout Management Plan. Created the first special regulations for the Agulowak River. In response to conservation concerns raised by the department, summer bag limits were reduced to 1 rainbow trout daily and terminal tackle was limited to single-hook artificial lures.
- 1996. Entire river and Lake Aleknagik within ½ mile of the outlet of Agulowak River restricted to single-hook artificial lures. While designed to protect char, this also added protection to rainbow trout in the lower section of the river.

A stock assessment survey on the Agulowak River in 1992 indicated that restrictive regulations adopted in 1990 were having the desired effect (Dunaway 1993). The project estimated 9,000 to 18,000 rainbow trout over 250 mm (10 inches) in the river and found the population to contain a significantly greater proportion of older fish than was observed in 1988. Size distributions approached those first recorded in the mid 1970s.

### **Management Objectives**

Agulowak River rainbow trout stocks are being managed to restore and maintain the historical age and size composition reported in the 1980s.

### **1998 Season**

No surveys were conducted on the Agulowak River rainbow trout fishery in 1998. Incidental contacts with anglers suggested that fishing was excellent. Guided use of the river continues to grow with relatively heavy use throughout the months of June through September. August and September are probably the highest use months of the season. A dozen or more guide boats, carrying two to four anglers each, use the river daily in August and September.

Local unguided use appears to have grown as well. However, crowding is an increasing complaint and many local, unguided anglers report avoiding the Agulowak.

The Agulowak is also an important thoroughfare to the upper lakes and streams of the Wood River Lakes system. The river is seeing greatly increased boat traffic as more land allotments are conveyed and developed and as more local boaters obtain jet boats. The congestion from increased angler use and general boat traffic is creating a safety hazard and is becoming an issue locally.

### **1999 Outlook**

Sport fishing for Agulowak River rainbow trout is expected to be good to excellent all season. The best fishing opportunity will likely occur when the spring runoff has passed and water levels begin to drop. Reduction in water levels and the presence of spawning salmon in August make for a very good fishing opportunity.

## **AGULUKPAK RIVER**

### **Fishery Description**

The Agulukpak River is one of the best known rainbow trout fisheries west of the Kvichak River. The river is 2.4 km (1.5 miles) long and drains from Lake Beverly into Lake Nerka in the Wood-Tikchik State Park north of Dillingham. The river's remote location and hazardous rocks in its lower section discourage boat access and most anglers come to the river via float-equipped aircraft. Development of the Agulukpak River fishery is virtually identical to the development of the Agulowak River, but other than one small cabin, no lodges were ever built close to the river.

The river is clear, shallow, about 100 yards wide, and easily waded in its upper section. Its remote location, and abundant rainbow trout, Arctic grayling, and Arctic char populations make the Agulupak River a premier location for fly fishermen. The sport fishery occurs from spring until freeze-up, mainly in the upper mile of the river.

### **Historical Performance**

The Agulupak River has received slightly more attention than the Agulowak River fishery but historical quantitative information remains somewhat scarce. The remote location of the fishery and a tradition of conservative use by many of the visiting anglers served to protect the Agulupak River rainbow trout population. Informal investigations of the sport fishery during 1976 and 1977 suggested that sport fishing effort, catch, and harvest were increasing. The first definitive work conducted on the Agulupak River was a creel survey program during the seasons of 1986, 1987, and 1988 (Minard 1989b). Angler effort was estimated to range from 1,826 to 4,265 angler-hours per year. Sport catch of rainbow trout ranged from 1,322 to 3,692 fish and virtually no rainbow trout were harvested during the three seasons sampled (Table 27). The normal distributions of age and length of the fish sampled during the 3-year survey indicated the rainbow trout population was reasonably stable in the Agulupak River.

### **Management**

Sport effort, catch, and harvest are estimated via the statewide harvest, catch, and participation survey (Mills 1979-1994, Howe et al. 1995-1999). Once buried as part of the estimate for the Wood River Lakes System, the statewide survey began making separate annual estimates of effort, catch and harvest for the Agulupak River in 1997 (Tables 6, 23, and 24). Future estimates will provide a convenient basis for comparisons. Subsistence harvests, considered slight but not well monitored, are the responsibility of the Commercial Fisheries Division. Onsite surveys yield detailed estimates of angler use and success. Biological information and demographic information were also collected during onsite surveys. Significant stock assessment and creel survey results have been reported by Minard (1989b and 1990), Dunaway (1993), and from 1996 by Rogan and Jaenicke (1997).

The following is a regulatory chronology for the Agulupak River:

- 1959. Year-round season and a bag limit of 15 fish per day, only 3 over 20 inches.
- 1962. Ten trout per day, only 2 over 20 inches.
- 1972. Five rainbow trout, 1 over 20 inches.
- 1984. Managed as a catch-and-release fishery with year-round open season. Catch-and-release restriction limited to the upper half of the Agulupak River.
- 1990. Implementation of the Southwest Alaska Rainbow Trout Management Plan in 1990 resulted in designation of the Agulupak River as a special management area with regulations for the upper half of the river permitting only fly fishing gear from June 8 until August 31, and permitting the use of single-hook artificial lures from September 1 until October 31. In addition, the harvest of rainbow trout was not permitted in the special management area from June 8 until October 31, while the daily bag limit from November 1 until June 7 became 5 rainbow trout, 1 over 20 inches.

The designation as a special management area in 1990 served to preserve the traditional character of the sport fishery as well as to protect the stocks of rainbow trout in the face of the increasing effort observed during the surveys of 1986 through 1988.

During the fall of 1992, a rainbow trout stock assessment survey and a limited, 53-day creel survey were conducted on the Agulukpak River to gauge whether significant changes in the stock status or the fishery had occurred since 1988. The 1992 study estimated the population of rainbow trout in the upper half of the Agulukpak River to range between 1,764 and 3,128 fish greater than 340 mm (13 in) in length (Dunaway 1993). A statistical comparison of the age and length data collected during 1987 and 1992 failed to detect any change in the rainbow trout size composition. Results from the 1992 creel survey showed 2,759 angler-hours of effort were spent to catch 1,862 rainbow trout (Table 27). A creel survey conducted in 1996 recorded the highest estimates of effort and catch observed in this fishery since surveys were initiated (Table 27, Rogan and Jaenicke 1997).

### **Management Objectives**

The Agulukpak River rainbow trout fishery is managed to maintain historical age and size composition and a diversity of angling opportunity by maintaining the special management designation of fly-fishing-only catch-and-release.

### **1998 Season**

No surveys were conducted on the Agulukpak River rainbow trout fishery in 1998. Incidental contacts with anglers suggested that fishing was considered excellent, but dependent on water level and temperature. Increasingly, concerns about crowding and diminished angling experience are heard regarding this fishery, particularly during the prime fall fishery.

### **1999 Outlook**

In recent seasons, the recreational fishery for rainbow trout on the Agulukpak River has been excellent. Angler success is often moderate from early spring until mid autumn after the salmon began to spawn. Fall fishing is typically best after the peak of the salmon spawning until freeze-up. Recent survey data (Rogan and Jaenicke 1997) suggest the present system of regulations adequately balances opportunity with stock conservation. No inseason changes are anticipated in 1999.

## **UPPER NUSHAGAK RIVER**

### **Fishery Description**

A less well known but increasingly popular rainbow trout fishery occurs in the upper reaches of the Nushagak River and tributaries north of the village of Koliganek. Particularly popular is the section known as the “braids” north of the confluence of the Nushagak River and Harris Creek. Rainbow trout can be found in this water in the spring after ice-out and again in the fall when large numbers of chum and chinook salmon spawn in the braids.

This is a remote, mainly guided fishery with anglers flown in for day trips from a number of the lodges based in the Wood/Tikchik lakes systems. One or two smaller lodges have been based in the area since at least the late 1980s. As other, more easily accessed waters have become popular with floaters, the number of guided and unguided float trips to this area has grown. Growth of the Mulchatna caribou herd in the area has brought hunters and anglers into this area as well. A few local anglers make the long trip to the area via jet boat from Dillingham, as well.

## **Historical Performance**

Little is known of this fishery. The annual mail survey does not identify this fishery separately from other fisheries on the Nushagak River. No onsite creel survey or other studies have been conducted in this area by the department. Largely through the voluntary work of a few guides, a small amount of biological data has been collected from rainbow trout in this area and nearby tributaries since the late 1970s.

This fishery began to grow in popularity in the late 1980s as the Rainbow Trout Management Plan was being developed. The upper Nushagak River was not part of the department's original proposal for special management waters under implementation of the plan. However, during the February 1990 meeting, concerned guides and anglers convinced the Board of Fisheries to establish catch-and-release regulations for rainbow trout in the Nushagak River drainage from its confluence with Harris Creek, upstream to its confluence with the Chichitnok River. In addition, single-hook artificial lure restrictions were adopted for this section of the river. The catch and release restrictions were originally in effect from June 8 until July 31, but were later changed to June to October 31 in accordance with similar waters in the SWMA.

## **Management**

The Upper Nushagak River rainbow trout fishery is managed to maintain historical age and size composition and a diversity of angling opportunity by maintaining the special management designation of catch-and-release and single-hook artificial lure regulations.

As with many of the area rainbow trout fisheries, the peak season restrictions from June 8 through October 31 give way to a daily bag limit of 5 rainbow trout per day, one over 20 inches during the remaining months of the year (ADF&G 1998b).

## **1998 Season**

Angling during the 1998 season was generally good to excellent. The strong chinook, chum and coho escapements provided much food for the local rainbow trout. As has been the history of this area, more growth in fishing effort was apparent again this season.

For the first time, department staff visited the area to collect data from rainbow trout and to assess the area's potential for a creel survey or fishery study (Schwanke *Unpublished b*). The specific objectives of the work were to: (1) estimate the weight and length compositions of rainbow trout at the upper Nushagak River, between Harris Creek and Chichitnok River, from August 1 through August 21, 1998; and (2) collect tissue samples from 60 rainbow trout in cooperation with the United States Fish and Wildlife Service for a pathology study on Southwest Alaska's rainbow trout populations.

From August 7 to August 19, 1998 a total of 241 rainbow trout, 185 Dolly Varden and 105 Arctic grayling were sampled between Harris Creek and the Chichitnok River (Schwanke *Unpublished b*). The mean length and weight of rainbow trout were 369 (SE=3.34) mm and 644 (SE=16.7) grams. The mean length and weight of Arctic grayling were 316 (SE=3.41) mm and 371 (SE=9.67) grams. The mean length and weight of Dolly Varden was 410 (SE=3.35) mm and 816 (SE=18.8) grams. Age was determined from the scales of 91 Arctic grayling and the majority (77 %) of the fish was 4 and 5 years old. On August 11 and 12 a total of 57 rainbow trout were sampled for the pathology study. The results are to be published by the United States Fish and Wildlife Service.

From this brief study, the total number of fish sampled during the 12-day survey period may indicate healthy populations of rainbow trout (Schwanke *Unpublished b*). Schwanke further concluded: “The upper Nushagak River currently provides recreational anglers with a multi-species fishery. The mean size of rainbow trout, Arctic grayling and Dolly Varden may not be as large as other fisheries in the region, but their abundance is encouraging. The commercial guiding outfits on the upper Nushagak River are currently spread out over the drainage. Surveys of this fishery by the Alaska Department of Fish and Game should occur periodically in future years to monitor the growth of the fishery.”

### **1999 Outlook**

This area should provide good rainbow trout angling opportunities for the 1999 season.

## **KANEKTOK RIVER**

### **Fishery Description**

One of the most popular rainbow trout fisheries in the SWMA occurs on the Kanektok River, where abundant and brilliantly colored rainbow trout offer excellent angling opportunities. This river is located in the Western section of the management area and drains west into the Kuskokwim Bay near the mouth of the Kuskokwim River (Figure 14). Mainly targeting salmon, the sport fishery has grown quickly since 1980, and subsequent conflicts between commercial and sport anglers drew statewide attention by the late 1980s. Changes in the management of the commercial fishery, and a drop in the level of sport fishing effort on the river, seem to have reduced the friction between the two groups. The river has become popular for float trips as air service from Dillingham has improved and as the river gained a reputation for excellent angling opportunities for abundant resident species as well as salmon. Angling effort appears to be growing again in recent years.

### **Historical Performance**

Estimates of effort and harvest have been generated from the Statewide Harvest Survey since 1983. Sport fishing effort climbed rapidly from 1,517 angler-days in 1983 to a peak of 12,697 in 1988, and then dropped markedly. Sport fishing effort for the period 1989 to 1993 averaged 4,150 angler-days annually (Table 6). Since 1994 effort has again grown, and in 1996 exceeded 8,000 angler-days and approached the levels observed in 1987 and 1988. Most effort is directed toward chinook and coho salmon but rainbow trout are an important attraction. The estimates of rainbow trout harvest are quite variable from year to year and averaged 146 rainbow trout per year from 1993 through 1997 (Table 23). The seven onsite creel surveys conducted on the Kanektok River by the department and the U.S. Fish and Wildlife Service targeted the salmon fisheries and did not encompass enough of the season to produce a useful estimate of the harvest of rainbow trout (Snellgrove *Unpublished*, Alt 1986, Minard 1987c, Minard 1990, Minard and Brookover 1988b, Wagner 1991, Dunaway and Bingham 1992b, Dunaway and Fleischman 1995a). The U. S. Fish and Wildlife Service studies of Kanektok River rainbow trout in 1993 and 1994 (Adams 1996) provide some information on size composition and distribution of the populations in the river.

### **Management**

Sport effort, catch, and harvest are estimated via the statewide harvest, catch, and participation survey (Mills 1979-1994, Howe et al. 1995-1999). Subsistence harvests are not well monitored and are managed by the Commercial Fisheries Division.

Because of the low effort and harvest, little regulatory or management attention has been devoted to the Kanektok River rainbow trout stocks. The following is a regulatory chronology for the Kanektok rainbow trout fishery:

- 1969. Year-round open season and daily bag limit of 15 fish (including rainbow trout) of which no more than 3 could exceed 20 inches in length.
- 1985. Bag limit reduced to 2 rainbow trout per day of any size.
- 1990. Single-hook artificial lures required for the Kanektok River upstream of the wilderness boundary in the Togiak National Wildlife Refuge. Sport fishing prohibited within 300 feet of a legally set subsistence gill net.
- 1998 Entire Kanektok River drainage restricted to unbaited single-hook artificial lures the entire year. June 8 through October 31, catch-and-release only for rainbow trout. November 1- June 7 daily bag and possession limit is 2 rainbow, only 1 over 20 inches.

There have been no indications that further management actions are necessary; however, occasional monitoring of this popular fishery would be prudent. Estimates of stock abundance would be useful in assessing stock status. Unfortunately the cost and difficulties associated with designing a statistically valid project on such a long river have so far confounded biologist's attempts to obtain sound assessments of this population or to measure the likely effects of the sport fishery (Adams 1996). The variety of salmon species which spawn in the river should impart a measure of stability to the population of Kanektok River rainbow trout by allowing it to be less dependent upon the success or failure of a single run of salmon.

### **Management Objectives**

The Kanektok River rainbow trout fishery is managed to maintain historical age and size composition, and abundance levels such that stocking is not needed to enhance or supplement the wild population.

### **1998 Season**

No surveys were conducted on the Kanektok River rainbow trout fishery in 1998. Incidental contacts with anglers provided a large range of opinion on the status of the fishery, but most anglers seem to have had good fishing. Sport fishing effort during the last few seasons has grown steadily from past years according to the U.S. Fish and Wildlife Service staff of the Togiak Refuge. Residents of the community of Quinhagak at the outlet of the Kanektok River, at least two commercial operators who use the river, and a number of private individuals continue to express concern for the use levels and angling pressure on the Kanektok River.

There seems to be good support for the new gear and bag limit restrictions adopted during the winter of 1997. It is notable that the latest restrictions were adopted with support from the local residents of Quinhagak.

### **1999 Outlook**

The Kanektok River rainbow trout fishery has been good to excellent in recent years and 1999 should be the same. Angling success on the Kanektok River in 1999 may depend on weather and water conditions. No inseason management actions are anticipated for the 1999 season.

## **NORTHWESTERN RAINBOW TROUT FISHERIES**

Northwestern section rainbow trout are found in the Aniak, Kisaralik, Kasigluk, and Kwethluk rivers, and probably other smaller adjacent tributaries which flow northwesterly into the Kuskokwim River from the Kilbuck Mountains. Until recently, most of the sport effort in this section was limited to the residents of communities along the lower Kuskokwim River. Since 1983, the sport fishery has grown as guides and outfitters from Bristol Bay and within the Kuskokwim drainage offer more services on these and other nearby rivers. The annual harvest of rainbow trout in the Northwestern section has ranged from 892 fish in 1983 to as low as 18 fish in 1988. From 1993-1997 harvest estimates have stabilized somewhat to average 291 fish per year (Table 23).

Rainbow trout in the Northwestern section are at the far extreme of their range in North America and can be characterized as slow growing, with small size at age, and not particularly abundant. The Northwestern section's severe environment is assumed to make its rainbow trout populations very sensitive to changes in climate and food availability. Sustaining a population which demonstrates such slow growth, low productivity, and environmental sensitivity typically requires conservative management strategies.

There are four special management areas in the Northwestern section. The oldest, established in 1990, is the Aniak River drainage. Above its confluence with the Doestock River the Aniak River is restricted to unbaited single-hook artificial lures for all species, and catch-and-release for rainbow trout.

During the December 1997 meeting, the Alaska Board of Fisheries established special management areas on the Kisaralik, Kasigluk, and Kwethluk rivers (Figures 15 and 17). The restrictions were proposed by the Kwethluk Joint Group and had strong local support. Much of the Kisaralik River was designated as a special management area, restricted to unbaited single-hook artificial lures for all species and catch-and-release only for rainbow trout (ADF&G 1998b).

The Kwethluk River above Three Step Mountain and the whole Kasigluk River were restricted to unbaited single-hook artificial lures for all species (Figure 17). Daily bag and possession limits for rainbow trout are 1 fish 14 inches or less in length. The length limit was based on the size rainbow trout are believed to reach sexual maturity in these rivers. The analysis was based on data collected from the Kwethluk and Kisaralik rivers by Ken Harper, USF&WS, Kenai Fisheries Research Office.

General growth of sport fishing in the Northwestern section and poor runs of chum salmon in 1993 and 1994 prompted concern from many local residents more accustomed to subsistence fisheries and few outside visitors. These concerns as well as the department's interest in monitoring unstudied "edge" rainbow trout populations resulted in two exploratory sport fishery projects on the Aniak River, the most popular water in the section. In 1993 Sport Fish Division staff spent 10 days in late July and August observing the sport fishery and collecting biological data from rainbow trout, char and grayling in the middle portion of the Aniak River. These data were a quick snap shot of the resident fish and fisheries and provided little quantitative information.

A more extensive project was conducted for 6 weeks in 1996 (Dunaway 1997). The anticipated poor chum salmon run was the major impetus behind the project but the department used the opportunity to become familiar with aspects of the area's fisheries and to assess the need and

feasibility for quantitative fisheries studies. The sport fishery on the Aniak River did not appear to be a threat to resident species populations, there was general local support for additional restrictions on the sport harvest of resident species. The sport fishery did not appear to conflict with the subsistence fisheries.

Recent years show sport effort is growing on the Kisaralik, Kwethluk, and Kasigluk rivers. These rivers are within the huge Yukon-Kuskokwim Delta (YKD) Wildlife Refuge. The lower reaches of these rivers support important subsistence fisheries for nearby villages as well as popular recreational fisheries for Bethel-based anglers. Nonlocal anglers are increasingly aware and interested in these rivers as well. A lake at the head of the Kisaralik River makes it attractive to rafting enthusiasts. Several falls or cascades in its upper reaches make it most suited to individuals with considerable wilderness experience. The accessibility, complex land ownership patterns and subsistence concerns spurred the refuge to complete a management plan for the uplands along this river in March of 1997 (USF&WS 1997). In 1997 the USF&WS began a study of the Kisaralik River rainbow trout population but reports are not yet available.

A similar study was begun by the USF&WS on the Kwethluk River in 1998 but work could not be completed and the project was extended into 1999 (Ken Harper, USF&WS, Fisheries Research office, Kenai, personal communication). Relatively difficult access appears to make the Kwethluk less appealing to float trip anglers. Most effort occurs in the lower river accessible by motorboat. In 1996 the USF&WS conducted some preliminary work and tagged many rainbow trout. The tagging had not been planned and was not conducted according to a rigorous study design (Ken Harper, USF&WS, Fisheries Research office, Kenai, personal communication). However the work succeeded in collecting the most extensive and only recent data on this fish population.

The department expects interest in the Northwestern section rainbow trout fisheries to grow and these stocks will eventually need additional monitoring and management strategies.



## **SECTION VII: OTHER SPECIES FISHERIES**

Southwest Alaska offers diverse sport fishing opportunity for a large variety of species that often go unnoticed because of the publicity given the more popular species. Arctic char/Dolly Varden, Arctic grayling, lake trout, and chum salmon, to name four, are species that contribute to the sport fishing pleasures of many anglers who fish the area. Harvest estimates are made annually for these "other species" and trends are followed for the more popular sport species. Estimates of harvest by species can be found in Appendix A of this report.

In the winter of 1997, the Board of Fisheries reduced the bag and possession for Dolly Varden/char and grayling throughout the Bristol Bay and Kuskokwim areas. In addition, the daily bag and possession limits for pike and sheefish were reduced in the Kuskokwim. In most cases, the older liberal bag limits were not causing biological problems, but growth of the sport fishery was a concern to many local residents. At the same time, the current ethic among many anglers tends to advocate very limited or no harvest. Therefore, the winter 1997 bag limit reductions enjoyed widespread support from most user groups. Undoubtedly the fish populations gained a greater measure of protection as well. The new regulations were first effective during the 1998 season (ADF&G 1998b). The new bag limits generated no complaints during the 1998 season.

### **WOOD RIVER LAKES ARCTIC CHAR**

#### **Fishery Description**

The recreational fishery for Arctic char in the Wood River Lakes is the largest fishery for this species in the SWMA. Before 1989, sport fishing effort in the Wood River Lakes averaged about 3,000 angler-days per year but since 1989 has averaged about 8,400 angler-days. Much of the effort is aimed at char and Dolly Varden, and the bulk of the sport harvest for these two species occurs at the mouths of the Agulowak and Agulukpak rivers.

#### **Historical Performance**

Abundance of Arctic char at the Agulowak River was first estimated in 1954. Since that time, abundance has been estimated for 1971-72 and 1975 through 1980. With the exception of 1980, abundance estimates indicated that a very stable population of 8,000 to 12,000 Arctic char was present at the mouth of the Agulowak.

Similar, but less extensive, data are available for the Agulukpak population. Abundance there was also stable, between 4,300 to 7,800 fish.

#### **Agulowak River/Lake Aleknagik Arctic Char**

A stock assessment project conducted in 1993 found the abundance of Arctic char at the mouth of the Agulowak River had declined from 12,000 to 5,000 fish over a 10-year period (Minard and Hasbrouck 1994). Sport harvests during the period of decline are thought to have been excessive. This prompted emergency order reduction in bag limits for the 1994 season. Restrictive regulations addressing this fishery were adopted by the Alaska Board of Fisheries in January of 1995. The new regulations reduced the daily bag limit from 10 to 2 fish per day and in possession, and required the use of single-hook artificial lures. Additionally, a single-hook artificial lure restriction was adopted for the portion of Lake Aleknagik within a half-mile radius of the mouth of the Agulowak River. These restrictions have been in place since 1994 season (by emergency order in 1994, and by regulation since 1995). Public acceptance appears good, as

does compliance. There are anecdotal indications that the char stocks at the Agulowak are recovering, suggesting that the regulatory changes have been sufficient to allow recovery to previous levels.

Since the Board action, harvests for the Wood River Lake system have remained fairly stable, around 1,200 fish per year. The vast majority of the harvest comes from the Agulowak River stock; the fishery at the Agulukpak is primarily catch-and-release.

The Aleknagik Lake char stocks were used intermittently to supply eggs to State hatcheries in the mid 1980s and early 1990s. When the 1993 abundance study (Minard and Hasbrouck 1994) found a significantly reduced char population, there was concern that egg takes may have been a contributing factor. Before any more egg takes were allowed, a population assessment had to be conducted. In the fall of 1997 a preliminary study (Skaugstad *Unpublished*) showed the population was not likely to suffer significant impacts from an egg take scheduled for 1998.

During October and November of 1998, about 450 Arctic char were caught with various means from Aleknagik Lake. About 400 of these fish were held in live pens until they ripened for spawning. Twenty-five fish died while being held, 13 from mink predation and the rest from apparent disease or fungal infections. In late November, the fish were spawned and released back into the lake. Approximately 230,000 eggs were taken during the project (Schwanke & Schwanke *Unpublished*).

## **Management**

Sport effort, catch, and harvest are estimated via the statewide harvest survey. Subsistence harvests are not well monitored and are managed by the Commercial Fisheries Division. Onsite surveys yield detailed estimates of angler use and success. Biological information and demographic information are also collected. Significant stock assessment and creel survey results have been reported by Minard (1989b), and Minard and Hasbrouck (1994).

## **Management Objectives**

The management objectives for this fishery are to:

1. Maintain the Agulukpak River stock at historic levels and sizes previously documented, and
2. Rebuild the Agulowak River stock to previously reported levels observed in the 1980s.

Management objectives for the Agulowak River stock will be addressed by keeping exploitation rates to less than 10% of the available stock size and by minimizing mortality associated with catch-and-release fishing.

## **1998 Season**

Sport fishing was reported excellent this season with many anglers remarking about the increased size of char available for capture. Although no formal follow-up work has been done concerning the Agulowak River stocks, it appears that the reduced bag limits, change in gear type, and public education campaign has resulted in some benefit to the stock. Periodic enforcement trips indicated a high degree of compliance with the new restrictions as well as a high degree of acceptance. Management objectives established for this fishery are being met. Adoption of the 3 per day bag limits for the rest of the drainage may afford additional protection to this important fishery.

## **1999 Outlook**

Agulowak River: Fishing is expected to continue to improve for several years. Catch rates are expected to be high in June and July. The daily bag limit remains at 2 fish per day.

Agulukpak River: This river has fished exceptionally well during the last several seasons and is expected to do so again in 1999.

## **KUSKOKWIM RIVER CHUM SALMON**

### **Fishery Description**

Kuskokwim River chum salmon stocks are harvested primarily for subsistence and commercial use. Subsistence use of chum salmon has been documented as early as 1922 when sporadic surveys were first conducted (Francisco et al. 1993, Burkey et al. 1997, 1998, 1999a). The subsistence fishery is subject to few restrictions and most subsistence fishing is accomplished by the use of drift and set gill nets. Directed commercial harvests started in 1971. The chum salmon fishery was allowed to expand with management consisting of catch monitoring. In 1983, escapement-based management was instituted.

The sport fishery for Kuskokwim chum salmon is a very minor component of the overall harvest. Most of the harvest takes place in tributary streams and other small fisheries targeting chinook salmon. The total sport harvest of chum salmon in the lower Kuskokwim River (Northwestern section) has ranged from 118 to 1,107 fish per year, and during 1993 through 1997 averaged 354 fish per year (Appendix A2). The Aniak River, a major tributary of the Kuskokwim, supports the largest sport fishery for chum salmon with a peak annual harvest of 1,140 fish estimated in 1989 (Appendix A2). Annual sport harvest of Aniak River chum salmon is usually much lower than the 1989 estimate, and from 1993 through 1997 averaged 129 fish (Appendix A2).

### **Management**

In 1983, chum salmon escapement goals were established for several Kuskokwim River tributary streams based on the average observed escapement in those waters since 1960. Basic to this management approach was the assumption that achieving these goals should maintain salmon returns at historic levels, and that observing returns from these escapements would allow for adjustment of the goals to achieve maximum sustained yield (Burkey et al. 1997, 1998, 1999a). The primary indicators have long been escapement enumeration by the Aniak River sonar, remote Kogruklu River weir, and aerial spawning ground surveys conducted by CFD. Other state or federal projects designed to assess salmon run strength in the Kuskokwim drainage have been added including test fishing, Bethel sonar, and various weirs on other tributaries. Reduced funding has since terminated some programs, some were abandoned as ineffective, and a couple weir projects were terminated when nearby communities asked for their removal.

Exceptionally poor runs of Kuskokwim River drainage chum salmon in 1993 and 1994 resulted in extensive restrictions in the sport and commercial fisheries. The sport harvest of chum salmon was prohibited by emergency order in 1993, and in 1994 an emergency order reduced the bag limit to 1 fish per day. On July 10, 1997, Emergency Order No. 2-CS-5-22-97 was issued closing sport fishing, including catch-and-release fishing, for chum salmon in the Kuskokwim River drainage for the 1997 season.

In 1996 and 1997, the Bureau of Indian Affairs provided funding for additional enumeration and research projects to address the potential long-term effects of the 1993 and 1994 returns.

Counting towers were installed on the Kwethluk and Takotna rivers and a weir on the George River. The projects were operated jointly by the department and local Native organizations. In addition, the department used a new sonar site and new sonar equipment on the Aniak River.

The poor chum runs lead the Sport Fish Division to conduct two informal fishery studies on the Aniak River. The first was a short 10 day visit to the middle section of the river in late July and August of 1993. Too late for the chum fishery, this project collected a small amount of biological data from rainbow trout, grayling, and Dolly Varden.

A second project was conducted on the Aniak River from late June through early August of 1996 (Dunaway 1997). This study was an opportunity to get oriented to the fishery and to assess the need and feasibility for more quantitative studies. Anglers and guides were interviewed to learn the timing of the fishery, species targeted, numbers of fish kept and released, and angler demographic information. Biological data were collected from sport-caught salmon and resident species. Over 70% of the anglers were guided, nonresident men. The lower river fishery is characterized by motor-boat-based anglers, both local and nonlocal. The nonlocal anglers are typically lodge-based and guided. The upper river fisheries are largely raft trippers, mainly guided accessing the Aniak via an airstrip along the Salmon River or other tributaries. Sport harvest appeared to be minimal and the sport fishery on the Aniak River did not appear to be a threat to salmon or resident species populations. The sport fishery did not appear to conflict with the subsistence fisheries. This sport fishery was small and diffuse and expensive to survey with a rigorous sample design.

The lower portion of the Kuskokwim River is divided into two commercial fishing districts, District 1 near Bethel, and District 2 that includes the river near the community of Aniak. The Kuskokwim River chum salmon subsistence and commercial fisheries continue to be managed for biological escapement goals in several key tributaries. Commercial fishery management actions are usually made after consultation with the Kuskokwim Working Group. The Working Group includes department representatives, commercial processing representatives, and individuals from communities along the length of the Kuskokwim River representing traditional knowledge, subsistence, commercial, and sport interests. Since 1996, Sport Fish staff from the Dillingham office have increased their participation in the group meetings via teleconferences.

### **Management Objectives**

Kuskokwim River chum salmon stocks are managed to achieve biological escapements of 30,000 fish past the Kogrukluks weir, and 250,000 fish past the Aniak River sonar counter. As additional weirs and counting projects come on line and mature, their data will likely contribute to management.

### **1998 Season**

The 1998 chum salmon return to the Kuskokwim River was expected to be poor based on parent-year escapement estimates of 1993 and 1994. Surprisingly, the 1998 chum salmon return was quite good, and the escapement goal of 250,000 fish was exceeded. The Aniak River sonar project estimated a total of 279,430 chum salmon returning to the Aniak River. The strong return allowed the sport fishery to proceed without restrictions for the season.

The 250,000 chum salmon escapement goal was achieved in the Aniak River, far better than was expected considering the poor parent return of 1993. Most other tributaries in the drainage did not produce as well and the total return to the Kuskokwim was well below average.

## **1999 Outlook**

Chum salmon return to the Kuskokwim primarily at 5 and 4 years of age. The 1994 parent run was above average while the 1995 run was about average. Thus the 1999 return is cautiously expected to be about average. (Note: with four poor returns in the last 10 seasons, the “average” has declined considerably). As in previous years, the 1999 season will be approached cautiously and emergency order restrictions are possible for all fisheries. Sport tackle restrictions currently apply to all, or portions of the Aniak, Kisaralik, Kasigluk, and Kwethluk rivers.

## **UGASHIK LAKES GRAYLING**

The Ugashik Lakes are located on the Alaska Peninsula, 560 km southwest of Anchorage, and are within the Alaska Peninsula National Wildlife Refuge. Two popular sport fishery areas are the Ugashik Narrows, which connect the Upper and Lower Ugashik lakes, and the Outlet, which includes the upper 2 km of the Ugashik River between Lower Ugashik Lake and a large lagoon. The Ugashik Narrows is approximately 0.5 km long, and consists of two main channels with moderately fast water. The Outlet consists of shallow, braided channels with moderately fast water. The Ugashik Lakes area is accessible only by float plane or by boat from the village of Ugashik, 40 km downstream from the Outlet.

## **Fishery Description**

Angler effort in the Ugashik Lakes area is concentrated at the Narrows and Outlet, with limited effort expended in other parts of the drainage (Jaenicke and Squibb *In prep*). Due to the inclement weather of the Alaska Peninsula and the remote nature of the Ugashik Narrows, fishing pressure is moderate. Three active lodges and one inactive sport fishing lodge are located in the Ugashik Lakes area. In addition, a number of lodges in the King Salmon area fly guests to the Ugashik Lakes for day fishing trips.

Species of interest in the sport fishery include Arctic grayling, coho and sockeye salmon, Arctic char/Dolly Varden, and lake trout. Annual sport harvest and catch are estimated for the drainage through the Alaska statewide sport fish harvest and participation survey (Mills 1979-1994, Howe et al. 1995-1999). Rainbow trout have never been officially documented in the drainage, but reports of catches and harvests of this species routinely appear in the sport fish harvest and participation survey (Mills 1992-1994, Howe et al. 1995-1999).

The primary attraction in the drainage has been the Ugashik Narrows that harbors a population of very large Arctic grayling. Studies seem to indicate that the grayling at this site are an accumulation of old large fish (Meyer 1990 and 1991). The Alaska state record for sport-caught Arctic grayling was caught in the Ugashik Narrows in 1981. From 1967 to 1998, 66 trophy fish certificates or honorary catch and release certificates were issued for Arctic grayling in the Ugashik River drainage (Jim Andel, ADF&G, Division of Sport Fish, Juneau, personal communication).

## **History**

Management of the sport fishery for Arctic grayling in the Ugashik River drainage has been conservative since 1969, when the bag limit was reduced to 2 fish per day. The entire drainage was closed to the taking of Arctic grayling during 1990-1994 after studies found declining and very low grayling populations of old fish and poor recruitment (Meyer 1990 and 1991, Villegas 1993). In 1995 the Board of Fisheries again allowed a sport harvest in portions of the drainage, with a 5 fish per day daily bag limit in the Ugashik River drainage, excluding the Ugashik

Narrows and Ugashik River for the period of 1995-1997. The Ugashik Narrows has been designated as a catch-and-release Arctic grayling fishery since 1995. The Ugashik River has been closed to Arctic grayling fishing since 1995. During their 1997 winter meeting, the Board of Fisheries reduced the daily limit where harvest is allowed to 2 fish per day, with no size restrictions (ADF&G 1998b).

Creel censuses were conducted in cooperative effort by Sport Fish Division and the U.S. Fish and Wildlife Service (USF&WS) Alaska Peninsula/Becharof National Wildlife Refuge at the Ugashik Narrows during 1987 and 1988 (Meyer 1991).

During much of early and mid 1990s, the Ugashik Narrows was the site of a controversy regarding public access easements for this popular angling site. The state sought to preserve a site easement on Lower Ugashik Lake and a trail easement running north along the west side of the Narrows to public lands along Upper Ugashik Lake. Fly-in anglers had a tradition of getting dropped off on the shores of one lake, angling along the shores of the Narrows and then getting picked up at the other lake at the end of the day. Frequent and rapid weather changes often made the different drop-off and pick-up sites a necessity for safe air travel. A Native corporation sought to obtain control of the lands along the Narrows and objected to establishment of the easements. From 1992 through 1997 there had been extensive legal discussions. The state accumulated extensive documentation establishing historical use of the site and trail, and showed its determination to secure these easements through litigation or a negotiated agreement. In August 1997 the Native corporation chose to relinquish its selection of these lands thereby allowing the lands to remain as public lands under the management of the Alaska Peninsula/Becharof National Wildlife Refuge. The Narrows and landing sites at both lakes continue to be accessible to the public. Note that a portion of land on the southeast side of the outlet is being conveyed to a private, Native allotment applicant.

### **Management Objectives**

Maintain historical abundance, distribution, and size composition of Arctic grayling.

### **1998 Season**

A joint USF&WS and ADF&G creel survey was conducted at the Ugashik Narrows from June 20 through September 14, 1998 (Jaenicke and Squibb *In prep*). This study originated from a need to update public use data for a revision of the comprehensive conservation plan of the Alaska Peninsula/Becharof National Wildlife Refuge (APB NWRC). The Ugashik Narrows were identified by staff of the King Salmon Fishery Resource Office (KSFRO) and the APB NWRC as the top priority among sites within the refuge complex where public use records were not current. In addition, the department was eager to have updated information on this well known fishery. Objectives of the study were to census the recreational fishing effort, catch, and harvest at the Narrows; census the distribution of catch and harvest success of anglers; collect angler demographics and estimate the length and age composition of the sport catch.

During the survey, the 348 anglers interviewed expended a total of 1,340 hours of angling effort (Jaenicke *In prep*). Jaenicke (*In prep*) concluded that effort at the narrows has declined from that observed in 1987. The majority of the catch consisted of Arctic grayling (991 released), and Dolly Varden and Arctic char (855 released, 23 kept). The typical angler was guided (66%), not an Alaskan resident (77%), used air charter to access the area (89%), fished from shore (99%), and used fly fishing gear (70%) (Jaenicke *In prep*). The 1998 demographic data are not

significantly different from the data collected in 1987. Review of previous mark-recapture projects at the Ugashik Narrows indicates a need for a large-scale mark-recapture project over at least a 3-year period, in conjunction with a radiotelemetry study, before the current population status of Arctic grayling is properly understood.

### **1999 Outlook**

The 1999 grayling fishery in the Ugashik Lakes drainage is expected to be very similar to the last few years.

## **SECTION VIII: 1998 MANAGEMENT ACTIONS**

No Southwest Alaska Management Area sport fisheries developed problems that required inseason restrictions or emergency orders during 1998.

### **LITERATURE CITED**

- Ackley, D. R. 1988. An economic evaluation of recreational fishing in Bristol Bay, Alaska. Master's thesis. University of Alaska, Juneau.
- Adams, F. J. 1996. Status of rainbow trout in the Kanektok River, Togiak National Wildlife Refuge, Alaska 1993-94. U. S. Fish and Wildlife Service, Alaska Fisheries Technical Report Number 39, King Salmon, Alaska.
- ADF&G (Alaska Department of Fish and Game). 1986. 1985 Bristol Bay annual management report. Division of Commercial Fisheries. Located at: Alaska Department of Fish and Game, Dillingham.
- ADF&G (Alaska Department of Fish and Game). 1990. Southwest Alaska rainbow trout management plan. Division of Sport Fish, Anchorage.
- ADF&G (Alaska Department of Fish and Game). 1992. Review of the Nushagak watershed coho salmon fisheries and stock status. Report to the Alaska Board of Fisheries. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 1D91-10, Anchorage.
- ADF&G (Alaska Department of Fish and Game). 1994. 1993 Annual management report for the subsistence and commercial fisheries of the Kuskokwim area. Division of Commercial Fisheries Management and Development, AYK Region. Regional Information Report No. 3A94-21, Anchorage.
- ADF&G (Alaska Department of Fish and Game). 1998a. Annual management report 1997, Bristol Bay Area. Division of Commercial Fisheries. Regional Information Report No. 2A98-08, Anchorage.
- ADF&G (Alaska Department of Fish and Game). 1998b. 1998 Sport fishing regulations summary, Bristol Bay and Kuskokwim Bay drainages. Alaska Department of Fish and Game, Division of Sport Fish, Juneau.
- ADF&G (Alaska Department of Fish and Game). 1999a. Management of sport fisheries in Southcentral Alaska: An overview of fisheries, issues, objectives, program expenditures, and benefits through 1998. Alaska Department of Fish and Game, Division of Sport Fish, Anchorage.
- ADF&G (Alaska Department of Fish and Game). 1999b. Annual management report 1998, Bristol Bay Area. Division of Commercial Fisheries, Regional Information Report No. 2A99-18, Anchorage.

## LITERATURE CITED (Continued)

- ADF&G (Alaska Department of Fish and Game). 1999c. 1999 Sport fishing regulations summary. Bristol Bay and Kuskokwim Bay drainages. Alaska Department of Fish and Game, Division of Sport Fish, Juneau.
- ADF&G (Alaska Department of Fish and Game). Unpublished. Alaska's recreational boating and sport fishing access program - F-13. Statewide 1995. Division of Sport Fish, Anchorage.
- ADNR (Alaska Department of Natural Resources), Alaska Department of Fish and Game, and Bristol Bay Coastal Resource Service Area. 1990. Nushagak and Mulchatna rivers recreation management plan. ADNR special publication, Anchorage.
- Alt, K. 1986. Kanektok River creel census. Alaska Department of Fish and Game, Federal Aid in Fish Restoration, Annual Performance Report, 1985-1986. Project F-10-1, 27 (S-62-1), Juneau.
- Berger, C. V. and L. A. Gwartney. 1986. A radio tagging study of Naknek drainage rainbow trout. U.S. National Park Service, Alaska Regional Office, Anchorage.
- Brookover, T. E. 1989a. Creel and escapement statistics for the Alagnak River during 1988. Alaska Department of Fish and Game, Fishery Data Series No. 89, Juneau.
- Brookover, T. E. 1989b. Catch, harvest, and size statistics for the rainbow trout fishery in the Tazimina River, Alaska, during 1987 and 1988. Alaska Department of Fish and Game, Fishery Data Series No. 112, Juneau.
- Browning, J. B., J. Regnart, and K. A. Weiland. 1998. Salmon spawning ground surveys in the Bristol Bay area, Alaska, 1997. Alaska Department of Fish and Game, Division of Commercial Fisheries Management and Development. Regional Information Report No. 2A98-34, Anchorage.
- Bucher, W. A. 1987. Salmon spawning ground surveys in Bristol Bay, 1985. Alaska Department of Fish and Game, ADF&G Technical Data Report No. 197, Juneau.
- Burkey, C., Jr., C. Anderson, M. Coffing, M. Fogarty, D. Huttunen, D. B. Molyneaux and C. Utermole. 1997. Annual management report for the subsistence and commercial fisheries for the Kuskokwim Area, 1995. Alaska Department of Fish and Game, Division of Commercial Fisheries Management and Development, AYK Region. Regional Information Report No. 3A97-22, Anchorage.
- Burkey, C., Jr., C. Anderson, T. Capiello, M. Coffing, D. Huttunen, J. Menard, D. B. Molyneaux and C. Utermole. 1998. Annual management report for the subsistence and commercial fisheries for the Kuskokwim Area, 1996. Alaska Department of Fish and Game, Division of Commercial Fisheries Management and Development, AYK Region. Regional Information Report No. 3A98-11, Anchorage.
- Burkey, C., Jr., M. Coffing, J. Menard, D. B. Molyneaux, C. Utermole, and T. Vania. 1999a. Annual management report for the subsistence and commercial fisheries for the Kuskokwim Area, 1997. Alaska Department of Fish and Game, Division of Commercial Fisheries, AYK Region. Regional Information Report No. 3A99-12, Anchorage.
- Burkey, C., Jr., M. Coffing, J. Menard, D. B. Molyneaux, P. Salomone, C. Utermole, and T. Vania. 1999b. Annual management report for the subsistence and commercial fisheries of the Kuskokwim Area, 1998. Alaska Department of Fish and Game, Division of Commercial Fisheries, AYK Region. Regional Information Report No. 3A99-36, Anchorage.
- Coggins, L. G. 1992. Creel and escapement statistics for the chinook and coho salmon fisheries in the lower Naknek River, Alaska, during 1991. Alaska Department of Fish and Game, Fishery Data Series No. 92-15, Anchorage.
- Coggins, L. G. and A. E. Bingham. 1993. Stock assessment of the chinook salmon return to the Naknek River, Alaska, during 1992. Alaska Department of Fish and Game, Fishery Data Series No. 93-26, Anchorage.
- Cross, B. A. 1991. Report to the Alaska Board of Fisheries spawning escapement goal evaluations for Kvichak River sockeye salmon. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 2A91-16, Anchorage.



## LITERATURE CITED (Continued)

- Cross, B. A. 1994. Report to the Alaska Board of Fisheries spawning escapement goal evaluations for Bristol Bay salmon. Alaska Department of Fish and Game, Division of Commercial Fisheries Management and Development, Regional Information Report 2A94-46, Anchorage.
- Cross, B. A., D. A. Gray, D. L. Crawford. 1997. Report to the Alaska Board of Fisheries spawning escapement goal evaluations for Bristol Bay salmon. Alaska Department of Fish and Game, Division of Commercial Fisheries Management and Development, Regional Information Report 2A97-30, Anchorage.
- Dunaway, D. O. 1990a. Creel and escapement statistics for the Alagnak River during 1989. Alaska Department of Fish and Game, Fishery Data Series No. 90-9, Anchorage.
- Dunaway, D. O. 1990b. Creel and escapement statistics for the Togiak River during 1989. Alaska Department of Fish and Game, Fishery Data Series No. 90-26, Anchorage.
- Dunaway, D. O. 1990c. Creel and escapement statistics for the Naknek River, Alaska, during 1989. Alaska Department of Fish and Game, Fishery Data Series No. 90-27, Anchorage.
- Dunaway, D. O. 1993a. Status of rainbow trout stocks in the Agulowak and Agulukpak rivers of Alaska during 1992. Alaska Department of Fish and Game, Fishery Data Series No. 93-41, Anchorage.
- Dunaway, D. O. 1993b. Unpublished. Memorandum to Dan Hourihan, Wood-Tikchik State Park. Fall creel survey and population estimates. Division of Sport Fish File 600-6.1-2-2: Agulowak and Agulukpak rainbow trout study 1992. Located at: ADF&G, P.O. box 230, Dillingham, AK 99576-0230.
- Dunaway, D. O. 1994. Surveys of the chinook and coho salmon sport fisheries in the Alagnak River, Alaska, 1993. Alaska Department of Fish and Game, Fishery Data Series No. 94-24, Anchorage.
- Dunaway, D. O. 1997. Monitoring the sport fisheries of the Aniak River, Alaska, 1996. Alaska Department of Fish and Game, Fishery Management Report No. 97-4, Anchorage.
- Dunaway, D. O. Unpublished. Naknek River rainbow trout projects 1993. Alaska Department of Fish and Game, Division of Sport Fish. Internal memo dated 28 January 1994, Dillingham.
- Dunaway, D. O. and A. E. Bingham. 1991. Creel and escapement statistics for the Naknek River, Alaska, during 1990. Alaska Department of Fish and Game, Fishery Data Series No. 91-12, Anchorage.
- Dunaway, D. O. and A. E. Bingham. 1992a. Creel surveys on the chinook salmon sport fishery on the lower Nushagak and middle Mulchatna River, Alaska, 1991. Alaska Department of Fish and Game, Fishery Data Series No. 92-16, Anchorage.
- Dunaway, D. O. and A. E. Bingham. 1992b. Creel surveys on the chinook and coho salmon sport fisheries on the lower Kanektok River, 1991. Alaska Department of Fish and Game, Fishery Data Series No. 92-23, Anchorage.
- Dunaway, D. O., A. E. Bingham and R. E. Minard. 1991. Effort, catch and harvest statistics for the chinook salmon sport fishery in the middle Mulchatna River, Alaska, during 1990. Alaska Department of Fish and Game, Fishery Data Series No. 91-40, Anchorage.
- Dunaway, D. O. and S. J. Fleischman. 1995a. Surveys of the chinook and coho salmon sport fisheries in the Kanektok River, Alaska, 1994. Alaska Department of Fish and Game, Fishery Data Series No. 95-22, Anchorage.
- Dunaway, D. O. and S. J. Fleischman. 1995b. Surveys of the chinook and coho salmon sport fisheries in the Nushagak and Mulchatna rivers, Alaska, 1994. Alaska Department of Fish and Game, Fishery Data Series No. 95-18, Anchorage.
- Dunaway, D. O. and S. J. Fleischman. 1996a. Surveys of chinook and coho salmon sport fisheries in the Lower Naknek River, Alaska, 1995. Alaska Department of Fish and Game, Fishery Data Series No. 96-10, Anchorage.
- Dunaway, D. O. and S. J. Fleischman. 1996b. Surveys of the sockeye salmon sport fishery in the upper Kvichak River, Alaska, 1995. Alaska Department of Fish and Game, Fishery Data Series No. 96-18, Anchorage.

## LITERATURE CITED (Continued)

- Dunaway, D. O. 1997. Monitoring the sport fisheries of the Aniak River, Alaska, 1996. Alaska Department of Fish and Game, Fishery Management Report No. 97-4, Anchorage.
- Dye, J. Unpublished. Lower Talarik Creek rainbow trout projects, 1997. Alaska Department of Fish and Game. Division of Sport Fish. Memo dated 15 October 1997, Dillingham.
- Eggers, D. M., and D. E. Rogers. 1987. The cycle of runs of sockeye Salmon *Oncorhynchus nerka* to the Kvichak River, Bristol Bay, Alaska: cyclic dominance or compensatory fishing? Pages 343-366 in H. D. Smith, L. Margolis, and C. C. Wood editors. Sockeye salmon *Oncorhynchus nerka* population biology and future management. Canadian Special Publications of Fisheries and Aquatic Science 96, Ottawa, Canada.
- Fair, L. Unpublished. Naknek River rainbow trout projects 1995. Alaska Department of Fish and Game, Division of Sport Fish. Memo dated 14 December 1995, Dillingham.
- Francisco, R. K., C. Anderson, C. Burkey, and D. Molyneaux. 1993. Kuskokwim area chum salmon, 1993. Report to the Alaska Board of Fisheries, Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Bethel, Alaska.
- Francisco, R. K., C. Anderson, C. Burkey Jr., M. Fogarty, D. B. Molyneaux, C. Utermole, and K. Vaught. 1995. Annual management report for the subsistence and commercial fisheries for the Kuskokwim Area 1994. Alaska Department of Fish and Game, Division of Commercial Fisheries Management and Development, AYK Region. Regional Information Report No. 3A95-15, Anchorage.
- Fried, S. M. 1984. Bristol Bay Pacific salmon spawning escapement goal workshop. Alaska Department of Fish and Game, Division of Commercial Fisheries, Bristol Bay Data Report 84-12, Anchorage.
- Geiger, H. J. and D. Hart. 1999. Run forecasts and harvest projections for 1999 Alaska salmon fisheries and review of the 1998 season. Commercial Fisheries Division, Regional Information Report 5J99-06, Juneau.
- Gryska, A. D. and G. P. Naughton. In prep. Surveys of the 1998 chinook and the 1999 coho salmon sport fisheries in the lower Togiak River. Alaska Department of Fish and Game, Fishery Data Series report, Anchorage.
- Hart, D., D. Petree, and H. J. Geiger. 1998. Run forecasts and harvest projections for 1998 Alaska salmon fisheries and review of the 1997 season. Alaska Department of Fish and Game, Commercial Fisheries Division, Regional Information Report No. 5J98-01, Juneau.
- Howe, A. L., G. Fidler, and M. J. Mills. 1995. Harvest, catch, and participation in Alaska sport fisheries during 1994. Alaska Department of Fish and Game, Fishery Data Series No. 95-24, Anchorage.
- Howe, A. L., G. Fidler, A. E. Bingham, and M. J. Mills. 1996. Harvest, catch, and participation in Alaska sport fisheries during 1995. Alaska Department of Fish and Game, Fishery Data Series No. 96-32, Anchorage.
- Howe, A. L., G. Fidler, C. Olnes, A. E. Bingham, and M. J. Mills. 1997. Harvest, catch, and participation in Alaska sport fisheries during 1996. Alaska Department of Fish and Game, Fishery Data Series No. 97-29, Anchorage.
- Howe, A. L., G. Fidler, C. Olnes, A. E. Bingham, and M. J. Mills. 1998. Harvest, catch, and participation in Alaska sport fisheries during 1997. Alaska Department of Fish and Game, Fishery Data Series No. 98-25, Anchorage.
- Howe, A. L., R. J. Walker, C. Olnes, G. Heineman, and A. E. Bingham. 1999. Harvest and catch in Alaska sport fisheries during 1998. Alaska Department of Fish and Game, Fishery Data Series No. 99-41, Anchorage.
- Jaenicke, M. J. 1998a. Survey of the rainbow trout sport fishery on the Nonvianuk and Alagnak rivers, 1996. Alaska Department of Fish and Game, Fishery Data Series No. 98-13, Anchorage.
- Jaenicke, M. J. 1998b. Survey of the rainbow trout sport fishery on the upper Alagnak River, Alaska, during June 1997. Alaska Department of Fish and Game, Fishery Data Series No. 98-27, Anchorage.
- Jaenicke, M. J. 1999. Survey of the Dolly Varden and rainbow trout populations in the Iliamna River, 1996 and 1997. Alaska Department of Fish and Game, Fishery Data Series No. 99-25, Anchorage.

## LITERATURE CITED (Continued)

- Jaenicke, M. J. Unpublished. Angler opinion survey, rainbow trout projects, Nonvianuk River June 1996, Alagnak River June 1997. Alaska Department of Fish and Game, Division of Sport Fish. Memo dated 15 October 1997, Dillingham, Alaska.
- Jaenicke, M. J. and R. C. Squibb. In prep. Survey of the sport fishy at Ugashik Narrows, 1998. Alaska Department of Fish and Game, Fishery Data Series report, Anchorage.
- Lisac, M. J., and R. MacDonald. 1995. Age distribution of chinook salmon escapement samples, Togiak National Wildlife Refuge, Alaska, 1994. U. S. Fish and Wildlife Service, Fishery Data Series Number 95-4. Dillingham, Alaska.
- MacDonald, R. 1996. Age distribution of chinook salmon escapement samples, Togiak National Wildlife Refuge, Alaska, 1995. U. S. Fish and Wildlife Service, Fishery Data Series Number 96-6. Dillingham, Alaska.
- Meyer, S. C. 1990. Stock assessment of Arctic grayling in Ugashik Lakes, Alaska. Master's. thesis, University of Alaska, Fairbanks.
- Meyer, S. C. 1991. Estimates of sport fishing effort, catch, and harvest at Ugashik Narrows and outlet, 1987-1988. Alaska Department of Fish and Game, Fishery Data Series No. 91-3, Anchorage.
- Miller, J. D. 1998. Sonar enumeration of Pacific salmon escapement into Nushagak River, 1997. Alaska Department of Fish and Game, Division of Commercial Fisheries Management and Development, Regional Information Report No. 2A98-16, Anchorage.
- Mills, M. J. 1979. Alaska statewide sport fish harvest studies. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1978-1979, Project F-9-11, 20 (SW-1), Juneau.
- Mills, M. J. 1980. Alaska statewide sport fish harvest studies. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1979-1980, Project F-9-12, 21 (SW-1), Juneau.
- Mills, M. J. 1981a. Alaska statewide sport fish harvest studies (1979). Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1980-1981, Project F-9-13, 22 (SW-I-A), Juneau.
- Mills, M. J. 1981b. Alaska statewide sport fish harvest studies (1980). Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1980-1981, Project F-9-13, 22 (SW-I-A), Juneau.
- Mills, M. J. 1982. Alaska statewide sport fish harvest studies (1981). Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1981-1982, Project F-9-14, 23 (SW-I-A), Juneau.
- Mills, M. J. 1983. Alaska statewide sport fish harvest studies (1982). Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1982-1983, Project F-9-15, 24 (SW-I-A), Juneau.
- Mills, M. J. 1984. Alaska statewide sport fish harvest studies (1983). Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1983-1984, Project F-9-16, 25 (SW-I-A), Juneau.
- Mills, M. J. 1985. Alaska statewide sport fish harvest studies (1984). Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1984-1985, Project F-9-17, 26 (SW-I-A), Juneau.
- Mills, M. J. 1986. Alaska statewide sport fish harvest studies (1985). Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1985-1986, Project F-10-1, 27 (RT-2), Juneau.
- Mills, M. J. 1987. Alaska statewide sport fisheries harvest report. Alaska Department of Fish and Game, Fishery Data Series No. 2, Juneau.
- Mills, M. J. 1988. Alaska statewide sport fisheries harvest report. Alaska Department of Fish and Game, Fishery Data Series No. 52, Juneau.
- Mills, M. J. 1989. Alaska statewide sport fisheries harvest report. Alaska Department of Fish and Game, Fishery Data Series No. 122, Juneau.

## LITERATURE CITED (Continued)

- Mills, M. J. 1990. Harvest and participation in Alaska sport fisheries during 1989. Alaska Department of Fish and Game, Fishery Data Series No. 90-44, Anchorage.
- Mills, M. J. 1991. Harvest, catch, and participation in Alaska sport fisheries during 1990. Alaska Department of Fish and Game, Fishery Data Series No. 91-58, Anchorage.
- Mills, M. J. 1992. Harvest, catch, and participation in Alaska sport fisheries during 1991. Alaska Department of Fish and Game, Fishery Data Series No. 92-40, Anchorage.
- Mills, M. J. 1993. Harvest, catch, and participation in Alaska sport fisheries during 1992. Alaska Department of Fish and Game, Fishery Data Series No. 93-42, Anchorage.
- Mills, M. J. 1994. Harvest, catch, and participation in Alaska sport fisheries during 1993. Alaska Department of Fish and Game, Fishery Data Series No. 94-28, Anchorage.
- Minard, R. E. 1987a. Effort and catch statistics for the chinook salmon sport fishery in the lower Naknek River, 1986. Alaska Department of Fish and Game, Fishery Data Series No. 28, Juneau.
- Minard, R. E. 1987b. Effort and catch statistics for the chinook salmon (*Oncorhynchus tshawytscha*) sport fishery in the lower Nushagak River, 1986. Alaska Department of Fish and Game, Fishery Data Series No. 15, Juneau.
- Minard, R. E. 1987c. Effort and catch statistics for the sport fishery in the lower Kanektok River, 1986. Alaska Department of Fish and Game, Fishery Data Series No. 29, Juneau.
- Minard, R. E. 1989a. Creel and escapement statistics Naknek River, Alaska, during 1988. Alaska Department of Fish and Game, Fishery Data Series No. 91, Juneau.
- Minard, R. E. 1989b. Effort, catch, and harvest statistics for the sport fisheries on the Agulupak and Agulowak rivers, Wood River Lake System, Alaska, 1986-1988. Alaska Department of Fish and Game, Fishery Data Series No. 90, Juneau.
- Minard, R. E. 1990. Rainbow trout stock status. Bristol Bay and Lower Kuskokwim Management Area. Report to the Alaska Board of Fisheries. Alaska Department of Fish and Game, Dillingham.
- Minard, R. E., M. Alexandersdottir and S. Sonnichsen. 1992. Estimation of abundance, seasonal distribution, and sex and age composition of rainbow trout in the Kvichak River, Alaska, 1986-1991. Alaska Department of Fish and Game, Fishery Data Series No. 92-51, Anchorage.
- Minard, R. E. and T. E. Brookover. 1988a. Effort and catch statistics for the sport fishery in the Naknek River, 1987. Alaska Department of Fish and Game, Fishery Data Series No. 49, Juneau.
- Minard, R. E. and T. E. Brookover. 1988b. Effort and catch statistics for the sport fishery for chinook salmon (*O. tshawytscha*) in the lower Kanektok River, 1987. Alaska Department of Fish and Game, Fishery Data Series No. 44, Juneau.
- Minard, R. E. and T. E. Brookover. 1988c. Effort and catch statistics for the sport fishery for chinook salmon in the lower Nushagak River, 1987. Alaska Department of Fish and Game, Fishery Data Series No. 43, Juneau.
- Minard, R. E. and J. J. Hasbrouck. 1994. Stock assessment of Arctic char in the Agulowak and Agulupak rivers of the Wood River Lake System, 1993. Alaska Department of Fish and Game, Fishery Data Series No. 94-42, Anchorage.
- Minard, R. E. and M. Lisac. 1984. Togiak River sport fisheries studies, 1984. Alaska Department of Fish and Game, Commercial Fisheries Management and Development, Bristol Bay Data Report No. 84-18, Anchorage.
- Minard, R. E., D. O. Dunaway, and M. J. Jaenicke. 1998. Area management report for the recreational fisheries of the southwest Alaska sport fish management area, 1997. Alaska Department of Fish and Game, Fishery Management Report No. 98-3, Anchorage.

## LITERATURE CITED (Continued)

- Naughton, G. P. and A. D. Gryska. In prep a. Surveys of the 1998 coho salmon and 1999 chinook salmon sport fisheries in the lower Kanektok River, Alaska. Alaska Department of Fish and Game, Fishery Data Series report, Anchorage.
- Naughton, G. P. and A. D. Gryska. In prep b. Surveys of the chinook salmon sport fishery in the lower Alagnak River, Alaska, 1998. Alaska Department of Fish and Game, Fishery Data Series report, Anchorage.
- Nelson, R. 1997. Testimony before the Alaska Board of Fisheries, November 1997. Record Copy No. 70. Choggiung Limited, Department of Land Management. Dillingham, Alaska.
- NPS (National Park Service). 1996. Final development concept plan environmental impact statement Brooks River area Katmai National Park and Preserve, Alaska. NPS D-51A. United States Department of Interior, National Park Service, King Salmon, Alaska.
- Rogan, L. M., and M. J. Jaenicke. 1997. Survey of the rainbow trout sport fishery on the Agulupak River, Alaska, 1996. Alaska Department of Fish and Game, Fishery Data Series No. 97-38, Anchorage.
- Rogers, D. E. and P. H. Poe. 1984. Escapement goals for the Kvichak River system. Unpublished Report FRI-UW-8407, Fisheries Research Institute, University of Washington, Seattle.
- Russell, R. B. 1977. Rainbow trout life history studies in Lower Talarik Creek, Kvichak drainage. Alaska Department of Fish and Game, Federal Aid in Fish Restoration. Project F-9-9, 18 (G-II):1-48, Juneau.
- Russell, R. B. 1985. 1985 summary of historical escapement data for king, chum, pink, and coho salmon in the Naknek/Kvichak, Egegik, and Ugashik drainages, 1926-1984. Alaska Department of Fish and Game, Commercial Fisheries Management and Development, Bristol Bay Data Report No. 85-4, Anchorage.
- Russell, R. B., J. R. Regnart, and T. E. Brookover. 1992. Salmon spawning ground surveys in the Bristol Bay area, Alaska, 1991. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 2A92-01, Anchorage.
- Schwanke, C. J. Unpublished a. Lower Talarik Creek rainbow trout projects, 1998. Alaska Department of Fish and Game. Division of Sport Fish. Memo dated 1 December 1998, Dillingham.
- Schwanke, C. J. Unpublished b. Upper Nushagak River rainbow trout project, 1998. Alaska Department of Fish and Game. Division of Sport Fish. Memo dated 19 November 1998, Dillingham.
- Schwanke, C. J. and C. Schwanke. Unpublished. Aleknagik Arctic char egg take. Alaska Department of Fish and Game. Division of Sport Fish. Memo dated 3 December 1998, Dillingham.
- Skaugstad, C. Unpublished. Arctic char survey at Lake Aleknagik. Alaska Department of Fish and Game. Division of Sport Fish. Memo dated 22 October 1997, Fairbanks.
- Snellgrove, J. Unpublished. Kanektok River sport fishery creel census, 1984. Alaska Department of Fish and Game, Commercial Fisheries Division, Bethel.
- USF&WS (U. S. Fish and Wildlife Service). 1991. Togiak National Wildlife Refuge, public use management plan and environmental assessment. Final. Togiak National Wildlife Refuge, Dillingham, Alaska.
- USF&WS (U. S. Fish and Wildlife Service). 1997. Kisaralik River management plan. Final plan decision notice. Finding of no significant impact. Yukon Delta National Wildlife Refuge. Bethel, Alaska.
- Villegas, S. V. 1993. Arctic grayling in the Ugashik Drainage. Master's thesis. University of Alaska, Fairbanks.
- Vincent-Lang, D., M. Alexandersdottir and D. McBride. 1993. Mortality of coho salmon caught and released using sport tackle in the Little Susitna River, Alaska. Fisheries Research 15(1993):339-356. Elsevier Science Publishers B.V., Amsterdam.

## **LITERATURE CITED (Continued)**

- Wagner, P. A. 1991. Southwestern Alaska rainbow trout investigations, Kanektok River, Togiak National Wildlife Refuge, Alaska, 1985-1987. Final report. U.S. Fish and Wildlife Service, Alaska Fisheries Technical Report No. 13, King Salmon, Alaska.
- Weiland, K. A., J. B. Browning, C. Anderson, and B. Glick. 1999. Salmon spawning ground surveys in the Bristol Bay area, Alaska, 1998. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 2A99-01, Anchorage.

## **APPENDIX A**

**Appendix A1.-Sport harvest of pink salmon from the waters of Southwest Alaska by fishery, 1977-1997.**

Drainage	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Eastern											
Ugashik	0	356	0	34	0	0	0	0	0 <sup>a</sup>	31 <sup>a</sup>	0
Egegik/Becharof	0	77	0	17	0	0	0	249 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>
Naknek R.	0	1,723	0	818	0	859	0	1,584	0	3,089	23
Naknek L.	0	0	0	0	0	0	0	0	12 <sup>a</sup>	0 <sup>a</sup>	0
Bay of Islands							0	0	0	0	0
Brooks R.	0	0	0	0	0	0	0	50	0	0	0
Brooks L.											
American Cr.							0 <sup>a</sup>	0 <sup>a</sup>	12 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>
King Salmon R.											
Kvichak R.	0	0	0	0	0	0	0	187	0	204	0
Copper R.	0	31	0	0	0	0	0	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>
Alagnak R.					0	0	0	748	0	0	0
Newhalen R.	0	0	0	0	0	0	0	0	0	0	0
L Talarik Cr.	0	0	0	0	0	0	0	0 <sup>a</sup>	0	0 <sup>a</sup>	0 <sup>a</sup>
Lake Clark	0	0	0	0	0	0	0	0	0	0	0
Lake Iliamna							0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0	0
Kulik R.											
Tazimina R.											
Moraine Cr.											
Other							0	25	0	0	0
Subtotal	0	2,187	0	869	0	859	0	2,843	24	3,324	23

-continued-



**Appendix A1.-Page 2 of 4.**

Drainage	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	5-Year Average
Eastern											
Ugashik	0 <sup>a</sup>	0	0	0	0	0	0	0	0	0	0
Egegik/Becharof	0 <sup>a</sup>	26	0	0	0	0	34	0	139	22	39
Naknek R.	2,939	26	512	10	119	9	25	35	86	0	31
Naknek L.	155 <sup>a</sup>	0	0	0	0	0	0	0	0	55	11
Bay of Islands	0 <sup>a</sup>	0	12	0	0	0	0	0	0	44	9
Brooks R.	0	26	97	0	101	0	0	19	0	11	6
Brooks L.			0	0	0	0	0	0	0	0	0
American Cr.	0 <sup>a</sup>	0	0	0 <sup>a</sup>	0	0	0	0	0	0	0
King Salmon R.					9	0	0	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0
Kvichak R.	62	101	141	218	119	0	24	0	0	0	5
Copper R.	0 <sup>a</sup>	0	0	0	0	0	0	0	0	0	0
Alagnak R.	0 <sup>a</sup>	25	94	150	192	60	73	19	317	22	98
Newhalen R.	0	0	0	0	0	0	0	0	0	0	0
L Talarik Cr.	0 <sup>a</sup>	0 <sup>a</sup>	0	0	0	0	0	0	0	0	0
Lake Clark	0 <sup>a</sup>	0	0	0	0	0	0	0	0	0	0
Lake Iliamna	0	25	0	0	0	43	8	0	99	0	30
Kulik R.					0	0	0	0	0	0	0
Tazimina R.					0	0	0	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0
Moraine Cr.					0	0	0	0	0	0	0
Other	990	51	12	122	101	112	102	75	114	96	100
Subtotal	4,146	280	868	500	641	224	266	148	755	250	329

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**Appendix A1.-Page 3 of 4.**

Drainage	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Central											
Nushagak	0	836	0	258	0	73	0	50	0	175	0
Mulchatna	0	0	0	0	0	0	0	12	0	0	109
Agulowak											
Agulukpak											
Wood River L.	0	31	0	0	0	0	0	50	43	0	0
Tikchik/Nuyakuk	0	232	0	60	0	0	0	0	0	0 <sup>a</sup>	0 <sup>a</sup>
Koktuli R.											
Other					0	0	0	0	0	0	0
Subtotal	0	1,099	0	318	0	73	0	112	43	175	109
Western											
Togiak	0	0	0	112	0	210	10	25	0 <sup>a</sup>	58	0 <sup>a</sup>
Goodnews							168	78 <sup>a</sup>	0	0 <sup>a</sup>	0 <sup>a</sup>
Kanektok							210	195	0	72	18
Arolik											
Other							0	0	0	0	
Subtotal	0	0	0	112	0	210	388	298	0	130	18
Northwestern											
Aniak							0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>
Kisaralik											
Kwethluk											
Other							0	0	0	0	0
Subtotal							0	0	0	0	0
Eastern	0	2,187	0	869	0	859	0	2,843	24	3,324	23
Central	0	1,099	0	318	0	73	0	112	43	175	109
Western	0	0	0	112	0	210	388	298	0	130	18
Northwestern							0	0	0	0	0
Total	0	3,286	0	1,299	0	1,142	388	3,253	67	3,629	150

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# Appendix A1.-Page 4 of 4.

Drainage	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	5-Year Average
Central											
Nushagak	31	182	90	11	165	0	38	144	174	295	130
Mulchatna	62	26	0	0	0	0	43	9	20	242	63
Agulowak										0 <sup>a</sup>	0
Agulukpak										0 <sup>a</sup>	0
Wood River L.	31	104	23	79	119	0	107	0	10	0	23
Tikhik/Nuyakuk	31	0	0	0	27	0	16	0	10	0	5
Koktuli R.					0	0	0	0 <sup>a</sup>	10	0 <sup>a</sup>	2
Other	0	0	23	0	0	0	0	0	20	26	9
Subtotal	155	312	136	90	311	0	204	153	244	563	233
Western											
Togiak	31 <sup>a</sup>	156	0	11	27	0	90	0	10	73	35
Goodnews	55 <sup>a</sup>	0	43 <sup>a</sup>	12	0	17	32	0	19	22	18
Kanektok	437	45	145	0	9	0	26	9	49	124	42
Arolik										0 <sup>a</sup>	0
Other	218	0	0	0	0	0	0	0	0	0	0
Subtotal	741	201	188	23	36	17	148	9	78	219	94
Northwestern											
Aniak	182 <sup>a</sup>	34	29	0	156	10	0	0	0	0	2
Kisaralik							0	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0
Kwethluk					27	0	51 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	10
Other	0	0	130	12	27	0	0	0	0	0	0
Subtotal	182	34	159	12	210	10	51	0	0	0	12
Eastern	4,146	280	868	500	641	224	266	148	755	250	329
Central	155	312	136	90	311	0	204	153	244	563	233
Western	741	201	188	23	36	17	148	9	78	219	94
Northwestern	182	34	159	12	210	10	51	0	0	0	12
Total	5,224	827	1,351	625	1,198	251	669	310	1,077	1,032	668

Source: Mills 1977-1994, Howe et al. 1995-1998. Unless otherwise noted, these are published estimates for sites that garnered 12 or more responses in the Statewide Harvest Survey.

<sup>a</sup> Unpublished estimates from Statewide Harvest Survey for sites with less than 12 responses.

**Appendix A2.-Sport harvest of chum salmon from the waters of Southwest Alaska by fishery, 1977-1997.**

Drainage	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Eastern											
Ugashik	0	20	0	0	0	0	0	0	0 <sup>a</sup>	61 <sup>a</sup>	104
Egegik/Becharof	0	78	0	0	0	0	0	37 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>
Naknek R.	78	302	18	86	54	126	31	112	124	387	243
Naknek L.	0	0	0	0	0	0	0	0	0	0	0
Bay of Islands							0	0	0	0 <sup>a</sup>	0
Brooks R.	0	0	0	0	0	0	0	0	0	0	0
Brooks L.											
American Cr.							0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>
King Salmon R.											
Kvichak R.	0	0	9	9	0	0	0	37	0	0	27
Copper R.	0	0	0	0	0	0	0	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>
Alagnak R.					108	0	0	287	53	68	219
Newhalen R.	0	0	0	0	0	0	0	0	0	0	0
L Talarik Cr.	0	0	0	0	0	0	0	0 <sup>a</sup>	0	0 <sup>a</sup>	0 <sup>a</sup>
Lake Clark	0	117	0	9	0	0	0	0	0	0	0
Lake Iliamna							0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0	0
Kulik R.											
Tazimina R.											
Moraine Cr.											
Other							10	0	12	0	35
Subtotal	78	517	27	104	162	126	41	473	189	516	628

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Appendix A2.-Page 2 of 4.

Drainage	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	5-Year Average
Eastern											
Ugashik	0 <sup>a</sup>	26	0	0	8	0	19	0	28	26	15
Egegik/Becharof	93 <sup>a</sup>	26	0	0	8	0	15	0	0	0	3
Naknek R.	371	260	239	398	175	34	36	173	47	106	79
Naknek L.	0	0	0	0	0	0	0	0	0	0	0
Bay of Islands	0 <sup>a</sup>	26	0	20	8	0	0	0	0	0	0
Brooks R.	0	0	0	0	0	0	0	0	0	0	0
Brooks L.			0	0	0	0	0	0	0	0	0
American Cr.	0 <sup>a</sup>	0	0	0 <sup>a</sup>	0	0	0	0	0	0	0
King Salmon R.					0	0	19	40 <sup>a</sup>	84 <sup>a</sup>	0 <sup>a</sup>	29
Kvichak R.	31	278	81	306	0	17	48	0	37	0	20
Copper R.	0 <sup>a</sup>	0	0	0	0	0	0	0	0	0	0
Alagnak R.	31 <sup>a</sup>	50	219	227	448	545	282	477	237	271	362
Newhalen R.	0	0	0	0	0	0	0	0	0	0	0
L Talarik Cr.	0 <sup>a</sup>	0 <sup>a</sup>	0	0	0	0	0	0	0	0	0
Lake Clark	0 <sup>a</sup>	0	0	0	0	0	0	0	0	0	0
Lake Iliamna	0	50	0	0	0	0	10	0	0	0	2
Kulik R.					0	0	0	0	0	0	0
Tazimina R.					0	0	0	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0
Moraine Cr.					0	0	0	0	0	0	0
Other	186	260	0	73	30	0	0	120	106	0	45
Subtotal	712	976	539	1,024	677	596	429	810	539	403	555

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**Appendix A2.-Page 3 of 4.**

Drainage	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Central											
Nushagak	24	117	64	17	130	293	336	399	72	117	54
Mulchatna	46	0	55	9	54	178	126	312	202	321	55
Agulowak											
Agulukpak											
Wood River L.	0	0	0	0	0	0	0	12	58	0	0
Tikchik/Nuyakuk	0	39	0	0	11	10	0	0	0	0 <sup>a</sup>	0 <sup>a</sup>
Koktuli R.											
Other					0	0	52	0	0	29	55
Subtotal	70	156	119	26	195	481	514	723	332	467	164
Western											
Togiak	0	59	36	17	22	168	199	37	14 <sup>a</sup>	0	27 <sup>a</sup>
Goodnews							10	130 <sup>a</sup>	124	0 <sup>a</sup>	84 <sup>a</sup>
Kanektok							315	376	323 <sup>b</sup>	316 <sup>b</sup>	112 <sup>b</sup>
Arolik											
Other							0	0	0	0	
Subtotal	0	59	36	17	22	168	524	543	461	316	223
Northwestern											
Aniak							115 <sup>a</sup>	26 <sup>a</sup>	75 <sup>a</sup>	98 <sup>a</sup>	70 <sup>a</sup>
Kisaralik											
Kwethluk											
Other							21	286	25	98	167
Subtotal							136	312	100	196	237
Eastern	78	517	27	104	162	126	41	473	189	516	628
Central	70	156	119	26	195	481	514	723	332	467	164
Western	0	59	36	17	22	168	524	543	461	316	223
Northwestern							136	312	100	196	237
Total	148	732	182	147	379	775	1,215	2,051	1,082	1,495	1,252

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# Appendix A2.-Page 4 of 4.

Drainage	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	5-Year Average
Central											
Nushagak	495	884	192	219	501	540	887	441	877	295	608
Mulchatna	124	156	203	55	175	133	64	83	197	242	144
Agulowak										0 <sup>a</sup>	0
Agulukpak										0 <sup>a</sup>	0
Wood River L.	124	26	24	119	8	33	7	0	28	0	14
Tikchik/Nuyakuk	62	26	60	27	23	0	29	11	0	0	8
Koktuli R.					15	0	10	18 <sup>a</sup>	31	0 <sup>a</sup>	12
Other	31	26	0	0	0	26	77	10	38	26	35
Subtotal	836	1,118	479	420	722	732	1,074	563	1,171	563	821
Western											
Togiak	155 <sup>a</sup>	130	24	37	8	17	153	105	64	73	82
Goodnews	18 <sup>a</sup>	0	72 <sup>a</sup>	189	0	156	15	0	0	22	39
Kanektok	618	537	202	80	251	183	156	213	200	124	175
Arolik										0 <sup>a</sup>	0
Other	73	26	0	0	0	0	0	0	23	0	5
Subtotal	864	693	298	306	259	356	324	318	287	219	301
Northwestern											
Aniak	91 <sup>a</sup>	1,140	159	169	304	101	231	127	110	77	129
Kisaralik							58	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	15
Kwethluk					30	0	15 <sup>a</sup>	90 <sup>a</sup>	56 <sup>a</sup>	0 <sup>a</sup>	32
Other	36	525	259	80	183	17	803	9	9	66	181
Subtotal	127	1,665	418	249	517	118	1,107	226	175	143	354
Eastern	712	976	539	1,024	677	596	429	120	539	403	417
Central	836	1,118	479	420	722	732	1,074	563	1,171	563	821
Western	864	693	298	306	259	356	324	318	287	219	301
Northwestern	127	1,665	418	249	517	118	1,107	226	175	143	354
Total	2,539	4,452	1,734	1,999	2,175	1,802	2,934	1,227	2,172	1,328	1,893

Source: Mills 1977-1994, Howe et al. 1995-1998. Unless otherwise noted, these are published estimates for sites which garnered 12 or more responses in the Statewide Harvest Survey.

<sup>a</sup> Unpublished estimates from Statewide Harvest Survey for sites with less than 12 responses.

<sup>b</sup> Estimates from onsite creel survey.

**Appendix A3.-Sport harvest of lake trout from the waters of Southwest Alaska by fishery, 1977-1997.**

Drainage	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Eastern											
Ugashik	14	45	9	9	11	10	10	37	52 <sup>a</sup>	3 <sup>a</sup>	172
Egegik/Becharof	0	0	0	0	0	0	0	12 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	21 <sup>a</sup>
Naknek R.	34	27	9	164	65	42	136	187	52	159	21
Naknek L.	23	0	18	155	130	84	105	25	17 <sup>a</sup>	40	236
Bay of Islands							52	312	121	76 <sup>a</sup>	150
Brooks R.	11	9	9	17	11	0	31	12	0	0	43
Brooks L.											
American Cr.							0 <sup>a</sup>	0 <sup>a</sup>	104 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>
King Salmon R.											
Kvichak R.	0	0	0	0	0	0	0	62	0	0	0
Copper R.	0	0	0	0	0	0	0	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>
Alagnak R.					0	0	0	0	0	1,257	0
Newhalen R.	0	0	0	0	0	0	0	0	15	0	0
L Talarik Cr.	0	0	0	0	0	0	0	0 <sup>a</sup>	0	0 <sup>a</sup>	0 <sup>a</sup>
Lake Clark	122	118	518	172	410	430	273	786	59	714	137
Lake Iliamna							0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0	46
Kulik R.											
Tazimina R.											
Moraine Cr.											
Other							94	112	548	144	422
Subtotal	204	199	563	517	627	566	701	1,545	968	2,393	1,248

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Drainage	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	5-Year Average
Eastern											
Ugashik	0 <sup>a</sup>	114	33	17	39	72	59	66	64	172	87
Egegik/Becharof	0 <sup>a</sup>	10	0	0	0	9	0	0	0	0	2
Naknek R.	36	10	33	17	8	28	44	0	112	26	42
Naknek L.	109 <sup>a</sup>	0	11	17	39	29	48	27	0	13	23
Bay of Islands	73 <sup>a</sup>	42	11	68	39	40	15	10	63	149	55
Brooks R.	18	10	11	0	0	9	0	0	0	0	2
Brooks L.			535	85	116	28	169	140	74	100	102
American Cr.	0 <sup>a</sup>	10	11	0 <sup>a</sup>	8	0	0	0	0	0	0
King Salmon R.					0	0	0	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0
Kvichak R.	36	30	0	14	0	0	69	0	46	0	23
Copper R.	0 <sup>a</sup>	10	0	0	0	0	0	0	0	0	0
Alagnak R.	73 <sup>a</sup>	20	74	14	8	83	15	0	9	9	23
Newhalen R.	0	20	21	127	39	20	143	29	0	113	61
L Talarik Cr.	0 <sup>a</sup>	0 <sup>a</sup>	0	0	0	0	0	0	0	0	0
Lake Clark	18 <sup>a</sup>	485	402	113	247	219	437	219	126	77	216
Lake Iliamna	18	30	42	0	46	156	194	0	18	26	79
Kulik R.					0	0	0	0	0	0	0
Tazimina R.					0	0	0	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0
Moraine Cr.					0	0	0	0	0	0	0
Other	199	238	93	110	294	207	271	32	120	94	145
Subtotal	580	1,029	1,277	582	883	900	1,464	523	632	779	860

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**Appendix A3.-Page 3 of 4.**

Drainage	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Central											
Nushagak	0	0	0	0	0	0	0	25	0	0	46
Mulchatna	0	0	27	0	0	0	0	0	29	88	92
Agulowak											
Agulukpak											
Wood River L.	0	0	0	0	0	0	42	0	0	0	0
Tikchik L.	28	45	45	69	194	10	21	87	58	0 <sup>a</sup>	275 <sup>a</sup>
Koktuli R.											
Other					0	0	1,259	37	0	58	367
Subtotal	28	45	72	69	194	10	1,322	149	87	146	780
Western											
Togiak	0	0	0	17	0	0	0	0	0 <sup>a</sup>	0	0 <sup>a</sup>
Goodnews							0	0 <sup>a</sup>	17	0 <sup>a</sup>	14 <sup>a</sup>
Kanektok							0	117	0	9	14
Arolik											
Other							0	52	0	0	
Subtotal	0	0	0	17	0	0	0	169	17	9	28
Northwestern											
Aniak							0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>
Kisaralik											
Kwethluk											
Other							0	0	0	1,101	0
Subtotal							0	0	0	1,101	0
Eastern	204	199	563	517	627	566	701	1,545	968	2,393	1,248
Central	28	45	72	69	194	10	1,322	149	87	146	780
Western	0	0	0	17	0	0	0	169	17	9	28
Northwestern							0	0	0	1,101	0
Total	232	244	635	603	821	576	2,023	1,863	1,072	3,649	2,056

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**Appendix A3.-Page 4 of 4.**

Drainage	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	5-Year Average
Central											
Nushagak	0	42	0	0	8	31	107	7	45	0	38
Mulchatna	437	0	11	0	0	0	156	9	0	0	33
Agulowak										86 <sup>a</sup>	86
Agulukpak										0 <sup>a</sup>	0
Wood River L.	0	0	0	0	0	51	22	0	0	0	15
Tikchik L.	327	437	176	86	31	192	55	76	207	53	117
Koktuli R.					0	0	0	0 <sup>a</sup>	0	0 <sup>a</sup>	0
Other	127	133	99	69	23	37	0	131	74	110	70
Subtotal	891	612	286	155	62	311	340	223	326	249	290
Western											
Togiak	0 <sup>a</sup>	10	0	0	39	0	0	0	18	0	4
Goodnews	0 <sup>a</sup>	38	0 <sup>a</sup>	0	0	9	22	20	9	27	17
Kanektok	0	959	0	0	0	0	18	80	27	133	52
Arolik										0 <sup>a</sup>	0
Other	0	328	18	0	15	0	0	0	0	13	3
Subtotal	0	1,335	18	0	54	9	40	100	54	173	75
Northwestern											
Aniak	36 <sup>a</sup>	63	18	0	47	0	231	61	9	67	74
Kisaralik							0	0 <sup>a</sup>	28 <sup>a</sup>	43 <sup>a</sup>	18
Kwethluk					0	0	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0
Other	0	55	18	215	309	160	0	29	53	158	80
Subtotal	36	118	36	215	356	160	231	90	90	268	168
Eastern	580	1,029	1,277	582	883	900	1,464	523	632	779	860
Central	891	612	286	155	62	311	340	223	326	249	290
Western	0	1,335	18	0	54	9	40	100	54	173	75
Northwestern	36	118	36	215	356	160	231	90	90	268	168
Total	1,507	3,094	1,617	952	1,355	1,380	2,075	936	1,102	1,469	1,392

Source: Mills 1977-1994, Howe et al. 1995-1998. Unless otherwise noted, these are published estimates for sites which garnered 12 or more responses in the Statewide Harvest Survey.

<sup>a</sup> Unpublished estimates from Statewide Harvest Survey for sites with less than 12 responses.

**Appendix A4.-Sport harvest of Dolly Varden/Arctic char from the waters of Southwest Alaska by fishery, 1977-1997.**

Drainage	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Eastern											
Ugashik	51	389	200	164	270	304	73	486	329 <sup>a</sup>	84 <sup>a</sup>	493
Egegik/Becharof	76	289	18	129	162	31	136	324 <sup>a</sup>	121 <sup>a</sup>	260 <sup>a</sup>	43 <sup>a</sup>
Naknek R.	195	127	527	1,679	1,609	786	808	2,831	416	1,506	13 <sup>b</sup>
Naknek L.	9	36	18	43	140	94	42	200	17 <sup>a</sup>	459	43
Bay of Islands							84	125	1,561	76 <sup>a</sup>	21
Brooks R.	71	90	0	9	0	0	27 <sup>b</sup>	0	17	0	21
Brooks L.											
American Cr.							10 <sup>a</sup>	0 <sup>a</sup>	191 <sup>a</sup>	0 <sup>a</sup>	64 <sup>a</sup>
King Salmon R.											
Kvichak R.	165	154	55	60	43	42	21	137	59	0	46
Copper R.	6	9	18	43	22	10	10	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	46 <sup>a</sup>
Alagnak R.					86	0	21	75	0	170	412
Newhalen R.	85	163	182	405	54	241	199	262	711	204	366
L Talarik Cr.	6	9	9	69	65	0	10	0 <sup>a</sup>	0	0 <sup>a</sup>	0 <sup>b</sup>
Lake Clark	25	9	136	77	173	859	126	37	15	0	46
Lake Iliamna							31 <sup>a</sup>	623 <sup>a</sup>	341 <sup>a</sup>	204	92
Kulik R.											
Tazimina R.											
Moraine Cr.											
Other	5						218	710	1,625	197	893
Subtotal	694	1,275	1,163	2,678	2,624	2,367	1,816	5,810	5,403	3,160	2,599

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Drainage	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	5-Year Average
Eastern											
Ugashik	200 <sup>a</sup>	104	164	165	41	248	275	77	90	274	193
Egegik/Becharof	346 <sup>a</sup>	52	207	166	180	171	193	0	210	259	167
Naknek R.	101 <sup>b</sup>	51 <sup>b</sup>	939	580	721	568	401	356	746	223	459
Naknek L.	128 <sup>a</sup>	145	0	179	0	19	47	117	0	27	42
Bay of Islands	54 <sup>a</sup>	42	11	41	66	28	9	11	51	23	24
Brooks R.	18	20	0	0	0	0	0	0	0	0	0
Brooks L.			11	0	8	0	0	0	0	0	0
American Cr.	0 <sup>a</sup>	42	22	442 <sup>a</sup>	8	44	199	96	142	156	127
King Salmon R.					33	10	0	10 <sup>a</sup>	101 <sup>a</sup>	0 <sup>a</sup>	24
Kvichak R.	18	71	63	84	180	89	187	19	20	47	72
Copper R.	0 <sup>a</sup>	20	0	118	16	9	57	0	0	0	13
Alagnak R.	36 <sup>a</sup>	30	21	84	139	54	18	192	266	405	187
Newhalen R.	127	91	106	355	131	190	145	198	142	163	168
L Talarik Cr.	36 <sup>a</sup>	10 <sup>b</sup>	0 <sup>b</sup>	84	82	0	0	0	0	0	0
Lake Clark	18 <sup>a</sup>	202	42	51	82	86	203	43	39	300	134
Lake Iliamna	18	30	63	51	98	106	100	22	20	230	96
Kulik R.					0	0	0	0	0	0	0
Tazimina R.					0	0	63	115 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	36
Moraine Cr.					0	0	18	0	0	0	4
Other	327	217	183	932	386	593	629	378	243	849	538
Subtotal	1,427	1,127	1,832	3,332	2,171	2,215	2,544	1,634	2,070	2,956	2,284

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Drainage	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Central											
Nushagak	23	45	136	206	151	231	346	274	159	29	138
Mulchatna	102	217	100	52	119	52	325	137	72	117	46
Agulowak											
Agulukpak											
Wood River L.	435	905	685	646	529	1,048	2,108	1,559	882	526	2,335
Tikchik L.	34	217	145	232	713	272	147	349	130	0 <sup>a</sup>	321 <sup>a</sup>
Koktuli R.											
Other					0	104	1,675	185	29	29	642
Subtotal	594	1,384	1,066	1,136	1,512	1,707	4,601	2,504	1,272	701	3,482
Western											
Togiak	133	72	236	560	345	671	1,007	758 <sup>b</sup>	178 <sup>b</sup>	1,133 <sup>b</sup>	547 <sup>b</sup>
Goodnews							147	195 <sup>a</sup>	780	0 <sup>a</sup>	306 <sup>a</sup>
Kanektok							1,406	1,116	815	656 <sup>b</sup>	752
Arolik											
Other							0	62	70	0	
Subtotal	133	72	236	560	345	671	2,560	2,131	1,843	1,789	1,605
Northwestern											
Aniak							105 <sup>a</sup>	91 <sup>a</sup>	69 <sup>a</sup>	245 <sup>a</sup>	56 <sup>a</sup>
Kisaralik											
Kwethluk											
Other							1,227	130	35	98	237
Subtotal							1,332	221	104	343	293
Eastern	694	1,275	1,163	2,678	2,624	2,367	1,816	5,810	5,403	3,160	2,599
Central	594	1,384	1,066	1,136	1,512	1,707	4,601	2,504	1,272	701	3,482
Western	133	72	236	560	345	671	2,560	2,131	1,843	1,789	1,605
Northwestern							1,332	221	104	343	293
Total	1,421	2,731	2,465	4,374	4,481	4,745	10,309	10,666	8,622	5,993	7,979

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Drainage	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	5-Year Average
Central											
Nushagak	36	31	77	144	254	270	272	273	571	652	408
Mulchatna	291	41	165	131	172	200	121	232	245	673	294
Agulowak										81 <sup>a</sup>	81
Agulukpak										57 <sup>a</sup>	57
Wood River L.	564	2,348	1,362	1,724	1,818	1,288	1,373	1,289	1,199	1,182	1,266
Tikchik L.	200	218	77	170	344	376	122	70	109	312	198
Koktuli R.					57	9	9	48 <sup>a</sup>	129	0 <sup>a</sup>	39
Other	36	145	638	39	41	47	93	248	90	408	177
Subtotal	1,127	2,783	2,319	2,208	2,686	2,190	1,990	2,160	2,343	3,365	2,410
Western											
Togiak	146 <sup>b</sup>	218	88	78	66	117	137	99	318	96	153
Goodnews	291 <sup>a</sup>	530	18 <sup>a</sup>	605	82	343	132	158	240	731	321
Kanektok	2,146	1,073	1,020	389	66	378	233	212	474	810	421
Arolik										24 <sup>a</sup>	24
Other	327	288	0 <sup>a</sup>	0	41	0	0	0	10	0	2
Subtotal	2,910	2,109	1,126	1,072	255	838	502	469	1,042	1,661	902
Northwestern											
Aniak	764 <sup>a</sup>	808	598	547	115	260	496	481	159	318	343
Kisaralik							117	22 <sup>a</sup>	238 <sup>a</sup>	366 <sup>a</sup>	186
Kwethluk					57	97	134 <sup>a</sup>	98 <sup>a</sup>	223 <sup>a</sup>	206 <sup>a</sup>	152
Other	0	655	89	476	433	334	187	201	260	313	259
Subtotal	764	1,463	687	1,023	605	691	934	802	880	1,203	902
Eastern	1,427	1,127	1,832	3,332	2,171	2,215	2,544	1,634	2,070	2,956	2,284
Central	1,127	2,783	2,319	2,208	2,686	2,190	1,990	2,160	2,343	3,365	2,410
Western	2,910	2,109	1,126	1,072	255	838	502	469	1,042	1,661	902
Northwestern	764	1,463	687	1,023	605	691	934	802	880	1,203	902
Total	6,228	7,482	5,964	7,635	5,717	5,934	5,970	5,065	6,335	9,185	6,498

Source: Mills 1977-1994, Howe et al. 1995-1998. Unless otherwise noted, these are published estimates for sites which garnered 12 or more responses in the Statewide Harvest Survey.

<sup>a</sup> Unpublished estimates from Statewide Harvest Survey for sites with less than 12 responses.

<sup>b</sup> Estimates from onsite creel survey.

**Appendix A5.-Sport harvest of Arctic grayling from the waters of Southwest Alaska by fishery, 1977-1997.**

Drainage	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Eastern											
Ugashik	141	72	145	215	195	142	168	237	87 <sup>a</sup>	122 <sup>a</sup>	278
Egegik/Becharof	59	81	55	43	140	105	94	249 <sup>a</sup>	87 <sup>a</sup>	0 <sup>a</sup>	21 <sup>a</sup>
Naknek R.	484	398	300	1,128	799	796	1,007	1,297	347	474	213 <sup>b</sup>
Naknek L.	17	0	18	0	0	105	10	12	0	153	21
Bay of Islands							0	0	0	0 <sup>a</sup>	0
Brooks R.	50	63	73	26	43	0	21	12	69	0	21
Brooks L.											
American Cr.							0 <sup>a</sup>	0 <sup>a</sup>	139 <sup>a</sup>	0 <sup>a</sup>	21 <sup>a</sup>
King Salmon R.											
Kvichak R.	361	579	136	207	162	136	63	87	311	68	504
Copper R.	0	0	0	0	0	73	31	0 <sup>a</sup>	15 <sup>a</sup>	0 <sup>a</sup>	92 <sup>a</sup>
Alagnak R.					119	52	94	436	518	578	138
Newhalen R.	88	172	164	207	54	576	252	536	681	102	641
L Talarik Cr.	60	36	18	86	65	63	10	0 <sup>a</sup>	0	9 <sup>b</sup>	19 <sup>b</sup>
Lake Clark	275	606	373	301	626	377	713	698	726	1,801	641
Lake Iliamna							0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0	46
Kulik R.											
Tazimina R.											
Moraine Cr.											
Other			118				115	361	429	0	681
Subtotal	1,535	2,007	1,400	2,213	2,203	2,425	2,578	3,925	3,409	3,307	3,337

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Drainage	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	5-Year Average
Eastern											
Ugashik	18 <sup>a</sup>	41	0	0	0	0	10	0	0	71	16
Egegik/Becharof	18 <sup>a</sup>	93	120	117	143	37	72	26	19	20	35
Naknek R.	157 <sup>b</sup>	128 <sup>b</sup>	197	337	316	501	240	185	140	271	267
Naknek L.	73 <sup>a</sup>	10	11	13	0	0	10	0	0	0	2
Bay of Islands	0 <sup>a</sup>	0	0	0	0	17	0	0	0	0	3
Brooks R.	36	42	11	52	0	0	0	0	0	0	0
Brooks L.			11	0	0	0	0	0	0	0	0
American Cr.	0 <sup>a</sup>	42	11	13 <sup>a</sup>	0	0	0	0	19	0	4
King Salmon R.					0	9	0	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	2
Kvichak R.	36	141	127	122	180	139	225	148	84	287	177
Copper R.	18 <sup>a</sup>	20	0	15	0	50	10	0	0	0	12
Alagnak R.	73 <sup>a</sup>	222	106	184	180	171	113	104	178	197	153
Newhalen R.	218	171	85	291	263	185	224	399	259	767	367
L Talarik Cr.	18 <sup>a</sup>	0 <sup>b</sup>	0	31	23	0	41	70	28	0	28
Lake Clark	54 <sup>a</sup>	313	402	168	548	568	568	270	262	359	405
Lake Iliamna	0	30	42	0	8	101	609	9	57	0	155
Kulik R.					0	0	0	0	0	0	0
Tazimina R.					0	76	200	62 <sup>a</sup>	41 <sup>a</sup>	41 <sup>a</sup>	84
Moraine Cr.					0	0	8	0	0	0	2
Other	127	195	401	469	340	244	440	50	366	376	295
Subtotal	846	1,448	1,524	1,812	2,001	2,098	2,770	1,323	1,453	2,389	2,007

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Drainage	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Central											
Nushagak	34	72	345	95	238	283	273	312	116	409	92
Mulchatna	59	443	227	103	324	1,373	462	461	347	438	870
Agulowak											
Agulukpak											
Wood River L.	201	199	527	525	259	587	692	237	159	58	92
Tikchik L.	108	199	318	775	400	84	776	274	347	175 <sup>a</sup>	92 <sup>a</sup>
Koktuli R.											
Other					0	260	2,097	374	58	380	2,107
Subtotal	402	913	1,417	1,498	1,221	2,587	4,300	1,658	1,027	1,460	3,253
Western											
Togiak	26	18	200	241	43	31	315	150	0 <sup>a</sup>	0	46 <sup>a</sup>
Goodnews							178	104 <sup>a</sup>	416	0 <sup>a</sup>	14 <sup>a</sup>
Kanektok							231	169	87	213	244
Arolik											
Other							0	0	0	0	
Subtotal	26	18	200	241	43	31	724	423	503	213	304
Northwestern											
Aniak							63 <sup>a</sup>	234 <sup>a</sup>	35 <sup>a</sup>	318 <sup>a</sup>	111 <sup>a</sup>
Kisaralik											
Kwethluk											
Other							1,364	26	746	195	237
Subtotal							1,427	260	781	513	348
Eastern	1,535	2,007	1,400	2,213	2,203	2,425	2,578	3,925	3,409	3,307	3,337
Central	402	913	1,417	1,498	1,221	2,587	4,300	1,658	1,027	1,460	3,253
Western	26	18	200	241	43	31	724	423	503	213	304
Northwestern							1,427	260	781	513	348
Total	1,963	2,938	3,017	3,952	3,467	5,043	9,029	6,266	5,720	5,493	7,242

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Drainage	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	5-Year Average
Central											
Nushagak	673	72	307	170	624	316	941	579	614	956	681
Mulchatna	1,037	260	285	425	210	762	314	604	580	407	533
Agulowak										29 <sup>a</sup>	29
Agulukpak										14 <sup>a</sup>	14
Wood River L.	164	104	220	524	143	212	345	218	9	197	196
Tikchik L.	91	93	296	1,473	218	650	112	266	278	311	323
Koktuli R.					45	101	398	34 <sup>a</sup>	197	0 <sup>a</sup>	146
Other	200	287	604	312	136	69	610	237	188	924	406
Subtotal	2,165	816	1,712	2,904	1,376	2,110	2,720	1,938	1,866	2,838	2,294
Western											
Togiak	109 <sup>a</sup>	62	0	0	23	65	20	26	28	29	34
Goodnews	200 <sup>a</sup>	198	53 <sup>a</sup>	122	0	17	0	14	47	68	29
Kanektok	164	58	123	54	23	25	0	0	0	107	26
Arolik										0 <sup>a</sup>	0
Other	255	0	0	0	128	0	0	0	0	0	0
Subtotal	728	318	176	176	174	107	20	40	75	204	89
Northwestern											
Aniak	273 <sup>a</sup>	909	422 <sup>a</sup>	1,085	121	288	116	53	103	187	149
Kisaralik							69	0 <sup>a</sup>	121 <sup>a</sup>	255 <sup>a</sup>	111
Kwethluk					75	47	49 <sup>a</sup>	88 <sup>a</sup>	28 <sup>a</sup>	187 <sup>a</sup>	80
Other	200	734	71	773	295	208	227	333	75	192	207
Subtotal	473	1,643	493	1,858	491	543	461	474	327	821	525
Eastern	846	1,448	1,524	1,812	2,001	2,098	2,770	1,323	1,453	2,389	2,007
Central	2,165	816	1,712	2,904	1,376	2,110	2,720	1,938	1,866	2,838	2,294
Western	728	318	176	176	174	107	20	40	75	204	89
Northwestern	473	1,643	493	1,858	491	543	461	474	327	821	525
Total	4,212	4,225	3,905	6,750	4,042	4,858	5,971	3,775	3,721	6,252	4,915

Source: Mills 1977-1994, Howe et al. 1995-1998. Unless otherwise noted, these are published estimates for sites which garnered 12 or more responses in the Statewide Harvest Survey.

<sup>a</sup> Unpublished estimates from Statewide Harvest Survey for sites with less than 12 responses.

<sup>b</sup> Estimates from onsite creel survey.

**Appendix A6.-Sport harvest of whitefish from the waters of Southwest Alaska by fishery, 1977-1997.**

Drainage	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Eastern											
Ugashik	0	0	0	0	0	0	0	0	0 <sup>a</sup>	0 <sup>a</sup>	21
Egegik/Becharof	0	0	0	0	0	0	0	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>
Naknek R.	5	25	0	17	43	0	10	12	0	122	43
Naknek L.	0	0	0	0	0	0	0	0	0 <sup>a</sup>	0 <sup>a</sup>	21
Bay of Islands							0	0	0	0 <sup>a</sup>	0
Brooks R.	0	0	0	0	0	0	0	0	0	0	21
Brooks L.											
American Cr.							0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>
King Salmon R.											
Kvichak R.	0	0	0	0	0	0	0	25	0	0	0
Copper R.	0	0	0	0	0	0	0	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>
Alagnak R.					0	0	0	25	0	34	46
Newhalen R.	0	0	0	0	0	0	0	0	0	0	0
L Talarik Cr.	0	0	0	0	0	0	0	0 <sup>a</sup>	0	0 <sup>a</sup>	0 <sup>a</sup>
Lake Clark	3	0	0	0	140	168	168	75	805	680	0
Lake Iliamna							0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0	0
Kulik R.											
Tazimina R.											
Moraine Cr.											
Other							0	0	350	34	0
Subtotal	8	25	0	17	183	168	178	137	1,155	870	152

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Drainage	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	5-Year Average
Eastern											
Ugashik	0 <sup>a</sup>	0	0	0	0	0	10	0	0	0	2
Egegik/Becharof	0 <sup>a</sup>	0	0	0	0	0	29	0	0	0	6
Naknek R.	18	20	17	40	55	0	0	0	0	0	0
Naknek L.	0 <sup>a</sup>	0	0	0	0	0	0	0	0	0	0
Bay of Islands	0 <sup>a</sup>	0	0	0	0	0	0	0	0	0	0
Brooks R.	0	0	0	0	0	0	0	0	0	0	0
Brooks L.			0	0	0	0	0	0	0	0	0
American Cr.	0 <sup>a</sup>	10	0	0 <sup>a</sup>	0	0	0	0	0	0	0
King Salmon R.					0	0	0	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0
Kvichak R.	18	10	0	0	46	0	39	9	0	0	10
Copper R.	0 <sup>a</sup>	10	0	0	0	0	0	0	0	0	0
Alagnak R.	0 <sup>a</sup>	10	17	0	0	16	14	9	20	0	12
Newhalen R.	0	10	67	0	0	0	0	64	10	21	19
L Talarik Cr.	0 <sup>a</sup>	0 <sup>a</sup>	0	0	0	0	0	0	0	0	0
Lake Clark	18 <sup>a</sup>	10	501	136	166	26	19	101	10	0	31
Lake Iliamna	0	10	0	0	0	9	0	0	0	0	2
Kulik R.					0	0	0	0	0	0	0
Tazimina R.					0	0	0	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0
Moraine Cr.					0	0	0	0	0	0	0
Other	18	0	33	0	9	44	87	83	0	0	43
Subtotal	72	90	635	176	276	95	198	266	40	21	124

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Drainage	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Central											
Nushagak	0	0	0	0	0	0	0	0	0	88	0
Mulchatna	0	0	0	0	0	0	0	0	0	0	46
Agulowak											
Agulukpak											
Wood River L.	0	0	0	0	0	0	0	12	0	0	0
Tikchik L.	0	0	0	0	0	0	0	125	0	0 <sup>a</sup>	0 <sup>a</sup>
Koktuli R.											
Other					0	0	0	0	0	0	0
Subtotal	0	0	0	0	0	0	0	137	0	88	46
Western											
Togiak	0	0	0	0	0	0	0	0	0 <sup>a</sup>	0	0 <sup>a</sup>
Goodnews							0	0 <sup>a</sup>	0	0 <sup>a</sup>	0 <sup>a</sup>
Kanektok							0	13	0	0	0
Arolik											
Other							0	0	0	0	
Subtotal	0	0	0	0	0	0	0	13	0	0	0
Northwestern											
Aniak							0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>
Kisaralik											
Kwethluk											
Other							198	0	175	0	49
Subtotal							198	0	175	0	49
Eastern	8	25	0	17	183	168	178	137	1,155	870	152
Central	0	0	0	0	0	0	0	137	0	88	46
Western	0	0	0	0	0	0	0	13	0	0	0
Northwestern							198	0	175	0	49
Total	8	25	0	17	183	168	376	287	1,330	958	247

-continued-

**Appendix A6.-Page 4 of 4.**

Drainage	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	5-Year Average
Central											
Nushagak	36	20	208	140	74	174	177	119	9	0	96
Mulchatna	18	31	87	0	18	87	0	0	0	0	17
Agulowak										0 <sup>a</sup>	0
Agulukpak										0 <sup>a</sup>	0
Wood River L.	0	20	521	0	0	35	24	0	0	0	12
Tikchik L.	0	10	0	0	9	0	0	0	9	0	2
Koktuli R.					0	0	0	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0
Other	0	0	17	260	0	0	0	0	0	21	4
Subtotal	54	81	833	400	101	296	201	119	18	21	131
Western											
Togiak	0 <sup>a</sup>	20	0	0	0	0	10	0	0	0	2
Goodnews	0 <sup>a</sup>	0	0 <sup>a</sup>	0	0	0	0	0	0	0	0
Kanektok	18	0	0	24	0	0	0	0	0	21	4
Arolik										0 <sup>a</sup>	0
Other	0	0	0	0	0	0	0	0	0	0	0
Subtotal	18	20	0	24	0	0	10	0	0	21	6
Northwestern											
Aniak	55 <sup>a</sup>	10	0	0	0	0	97	0	20	254	74
Kisaralik							0	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0
Kwethluk					0	0	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0
Other	18	30	70	134	258	166	0	0	0	42	42
Subtotal	73	40	70	134	258	166	97	0	20	296	116
Eastern	72	90	635	176	276	95	198	266	40	21	124
Central	54	81	833	400	101	296	201	119	18	21	131
Western	18	20	0	24	0	0	10	0	0	21	6
Northwestern	73	40	70	134	258	166	97	0	20	296	116
Total	217	231	1,538	734	635	557	506	385	78	359	377

Source: Mills 1977-1994, Howe et al. 1995-1998. Unless otherwise noted, these are published estimates for sites which garnered 12 or more responses in the Statewide Harvest Survey.

<sup>a</sup> Unpublished estimates from Statewide Harvest Survey for sites with less than 12 responses.

**Appendix A7.-Sport harvest of northern pike from the waters of Southwest Alaska by fishery, 1977-1997.**

Drainage	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Eastern											
Ugashik	0	0	0	0	0	0	0	0	17 <sup>a</sup>	0 <sup>a</sup>	64
Egegik/Becharof	0	0	0	0	0	0	0	0 <sup>a</sup>	0 <sup>a</sup>	18 <sup>a</sup>	0 <sup>a</sup>
Naknek R.	15	18	36	0	86	21	42	137	225	171	64
Naknek L.	12	9	9	26	22	63	21	0	17 <sup>a</sup>	0	21
Bay of Islands							10	62	35	15 <sup>a</sup>	64
Brooks R.	0	0	0	0	0	0	0	0	0	0	0
Brooks L.											
American Cr.							0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>
King Salmon R.											
Kvichak R.	0	0	0	0	0	0	0	0	15	68	0
Copper R.	0	0	18	0	0	0	0	12 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>
Alagnak R.					0	42	21	224	0	34	0
Newhalen R.	0	18	45	34	22	115	0	0	0	0	0
L Talarik Cr.	0	0	0	0	0	0	0	37 <sup>a</sup>	0	0 <sup>a</sup>	0 <sup>a</sup>
Lake Clark	43	54	127	43	162	409	84	87	104	0	46
Lake Iliamna							157 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	68	229
Kulik R.											
Tazimina R.											
Moraine Cr.											
Other							0	1,409	0	18	43
Subtotal	70	99	235	103	292	650	335	1,968	413	392	531

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Appendix A7.-Page 2 of 4.

Drainage	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	5-Year Average
Eastern											
Ugashik	0 <sup>a</sup>	31	11	0	17	19	278	0	85	157	108
Egegik/Becharof	0 <sup>a</sup>	0	0	0	0	0	0	0	0	50	10
Naknek R.	18	62	175	0	68	0	350	106	88	0	109
Naknek L.	0 <sup>a</sup>	10	0	62	68	0	27	0	29	25	16
Bay of Islands	0 <sup>a</sup>	41	22	31	60	75	54	59	93	204	97
Brooks R.	0	0	0	0	0	0	0	0	0	0	0
Brooks L.			0	0	0	0	0	0	0	0	0
American Cr.	0 <sup>a</sup>	0	0	0 <sup>a</sup>	0	8	0	0	0	0	2
King Salmon R.					0	0	0	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0
Kvichak R.	0	50	0	65	60	17	118	33	54	31	51
Copper R.	0 <sup>a</sup>	0	0	0	0	0	0	100	0	0	20
Alagnak R.	0 <sup>a</sup>	20	63	98	145	0	9	118	162	22	62
Newhalen R.	0	0	0	33	0	0	9	0	88	52	30
L Talarik Cr.	0 <sup>a</sup>	0 <sup>a</sup>	0	0	0	0	0	0	0	0	0
Lake Clark	0 <sup>a</sup>	40	85	196	162	247	128	19	109	96	120
Lake Iliamna	18	0	32	0	51	0	0	45	47	0	18
Kulik R.					0	0	0	0	0	0	0
Tazimina R.					0	0	0	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0
Moraine Cr.					0	0	0	0	0	0	0
Other	18	102	0	227	274	27	108	19	19	25	40
Subtotal	54	356	388	712	905	393	1,081	499	774	662	682

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**Appendix A7.-Page 3 of 4.**

Drainage	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Central											
Nushagak	5	63	9	26	43	42	178	50	202	58	595
Mulchatna	25	0	18	0	22	31	252	87	43	146	46
Agulowak											
Agulukpak											
Wood River L.	3	18	100	95	0	0	315	12	14	0	916
Tikchik L.	8	199	0	52	76	0	73	125	14	0 <sup>a</sup>	0 <sup>a</sup>
Koktuli R.											
Other					0	0	241	100	0	88	92
Subtotal	41	280	127	173	141	73	1,059	374	273	292	1,649
Western											
Togiak	12	0	0	0	0	84	0	25	0 <sup>a</sup>	29	0 <sup>a</sup>
Goodnews							0	0 <sup>a</sup>	0	0 <sup>a</sup>	0 <sup>a</sup>
Kanektok							0	0	0	0	0
Arolik											
Other							0	0	0	0	
Subtotal	12	0	0	0	0	84	0	25	0	29	0
Northwestern											
Aniak							42 <sup>a</sup>	78 <sup>a</sup>	17 <sup>a</sup>	98 <sup>a</sup>	125 <sup>a</sup>
Kisaralik											
Kwethluk											
Other							1,322	403	277	24	126
Subtotal							1,364	481	294	122	251
Eastern	70	99	235	103	292	650	335	1,968	413	392	531
Central	41	280	127	173	141	73	1,059	374	273	292	1,649
Western	12	0	0	0	0	84	0	25	0	29	0
Northwestern							1,364	481	294	122	251
Total	123	379	362	276	433	807	2,758	2,848	980	835	2,431

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# Appendix A7.-Page 4 of 4.

Drainage	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	5-Year Average
Central											
Nushagak	127	343	110	604	393	508	591	521	208	306	427
Mulchatna	91	31	44	14	26	74	9	21	168	24	59
Agulowak										0 <sup>a</sup>	0
Agulupak										0 <sup>a</sup>	0
Wood River L.	36	374	99	503	333	139	126	373	212	173	205
Tikchik L.	18	62	0	72	9	9	0	45	29	0	17
Koktuli R.					0	0	9	0 <sup>a</sup>	0	0 <sup>a</sup>	2
Other	36	93	77	57	0	0	55	70	111	0	47
Subtotal	308	903	330	1,250	761	730	790	1,030	728	503	756
Western											
Togiak	18 <sup>a</sup>	0	44	0	9	17	0	0	0	0	3
Goodnews	0 <sup>a</sup>	0	0 <sup>a</sup>	0	0	0	54	0	0	0	11
Kanektok	18	23	0	0	0	0	0	0	0	0	0
Arolik										0 <sup>a</sup>	0
Other	0	0	0	0	0	0	0	0	0	0	0
Subtotal	36	23	44	0	9	17	54	0	0	0	14
Northwestern											
Aniak	127 <sup>a</sup>	70	18	244	43	0	54	77	10	67	42
Kisaralik							0	29 <sup>a</sup>	88 <sup>a</sup>	31 <sup>a</sup>	37
Kwethluk					60	329	90 <sup>a</sup>	39 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	92
Other	36	781	124	294	182	170	358	129	158	53	174
Subtotal	163	851	142	538	285	499	502	274	256	151	336
Eastern	54	356	388	712	905	393	1,081	499	774	662	682
Central	308	903	330	1,250	761	730	790	1,030	728	503	756
Western	36	23	44	0	9	17	54	0	0	0	14
Northwestern	163	851	142	538	285	499	502	274	256	151	336
Total	561	2,133	904	2,500	1,960	1,639	2,427	1,803	1,758	1,316	1,789

Source: Mills 1977-1994, Howe et al. 1995-1998. Unless otherwise noted, these are published estimates for sites which garnered 12 or more responses in the Statewide Harvest Survey.

<sup>a</sup> Unpublished estimates from Statewide Harvest Survey for sites with less than 12 responses.

**Appendix A8.-Sport harvest of burbot from the waters of Southwest Alaska by fishery, 1977-1997.**

Drainage	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Eastern											
Ugashik	0	0	0	0	0	0	0	0	0 <sup>a</sup>	0 <sup>a</sup>	0
Egegik/Becharof	0	0	0	0	0	0	0	0	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>
Naknek R.	0	0	0	0	11	0	0	0	0	76	0
Naknek L.	0	0	0	0	0	0	10	0	0 <sup>a</sup>	0	0
Bay of Islands							0	0	0	0 <sup>a</sup>	0
Brooks R.	0	0	0	0	0	0	0	0	0	0	0
Brooks L.											
American Cr.							0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>
King Salmon R.											
Kvichak R.	0	0	0	0	0	0	0	12	0	0	0
Copper R.	0	0	0	0	0	0	0	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>
Alagnak R.					0	0	0	0	0	0	0
Newhalen R.	0	0	0	0	0	0	0	0	0	0	0
L Talarik Cr.	0	0	0	0	0	0	0	0 <sup>a</sup>	0	0 <sup>a</sup>	0 <sup>a</sup>
Lake Clark	0	0	227	0	0	0	0	112	105	204	0
Lake Iliamna							0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0	0
Kulik R.											
Tazimina R.											
Moraine Cr.											
Other							0	0	700	0	0
Subtotal	0	0	227	0	0	0	0	124	805	204	0

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Drainage	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	5-Year Average
Eastern											
Ugashik	0 <sup>a</sup>	0	0	0	0	0	0	0	0	0	0
Egegik/Becharof	0 <sup>a</sup>	0	0	0	0	0	0	0	0	0	0
Naknek R.	0	0	0	0	0	0	0	0	0	0	0
Naknek L.	0 <sup>a</sup>	0	0	0	0	0	0	0	0	0	0
Bay of Islands	0 <sup>a</sup>	0	0	0	0	0	0	0	0	0	0
Brooks R.	0	0	0	0	0	0	0	0	0	0	0
Brooks L.			0	0	0	0	0	0	0	0	0
American Cr.	0 <sup>a</sup>	0	0	0 <sup>a</sup>	0	0	0	0	0	0	0
King Salmon R.					0	0	0	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0
Kvichak R.	0	0	0	0	0	0	0	0	0	0	0
Copper R.	0 <sup>a</sup>	0	0	0	0	0	0	0	0	0	0
Alagnak R.	0 <sup>a</sup>	0	0	0	0	0	0	0	0	0	0
Newhalen R.	0	0	0	0	0	0	0	0	0	0	0
L Talarik Cr.	0 <sup>a</sup>	0 <sup>a</sup>	0	0	0	0	0	0	0	0	0
Lake Clark	18 <sup>a</sup>	0	100	53	0	0	0	0	18	147	33
Lake Iliamna	0	0	0	0	0	0	0	0	0	0	0
Kulik R.					0	0	0	0	0	0	0
Tazimina R.					0	0	0	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0
Moraine Cr.					0	0	0	0	0	0	0
Other	0	0	0	0	0	0	10	0	0	0	2
Subtotal	18	0	100	53	0	0	10	0	18	147	35

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Drainage	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Central											
Nushagak	0	0	0	0	0	0	0	0	0	0	0
Mulchatna	0	0	0	0	0	0	0	0	0	0	0
Agulowak											
Agulukpak											
Wood River L.	0	0	0	0	0	0	0	0	0	0	0
Tikchik L.	0	0	0	0	0	0	0	0	0	0 <sup>a</sup>	0 <sup>a</sup>
Koktuli R.											
Other					0	0	0	0	0	29	0
Subtotal	0	0	0	0	0	0	0	0	0	29	0
Western											
Togiak	0	0	0	0	0	0	0	0	0 <sup>a</sup>	0	0 <sup>a</sup>
Goodnews							0	0 <sup>a</sup>	0	0 <sup>a</sup>	0 <sup>a</sup>
Kanektok							0	0	0	0	0
Arolik											
Other							0	0	0	0	
Subtotal	0	0	0	0	0	0	0	0	0	0	0
Northwestern											
Aniak							0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	70 <sup>a</sup>
Kisaralik											
Kwethluk											
Other							189	0	35	122	14
Subtotal							189	0	35	122	84
Eastern	0	0	227	0	0	0	0	124	805	204	0
Central	0	0	0	0	0	0	0	0	0	29	0
Western	0	0	0	0	0	0	0	0	0	0	0
Northwestern							189	0	35	122	84
Total	0	0	227	0	0	0	189	124	840	355	84

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**Appendix A8.-Page 4 of 4.**

Drainage	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	5-Year Average
Central											
Nushagak	0	0	0	0	0	0	0	0	0	0	0
Mulchatna	0	0	17	0	0	0	0	0	0	0	0
Agulowak										0 <sup>a</sup>	0
Agulukpak										0 <sup>a</sup>	0
Wood River L.	0	0	0	0	0	0	0	0	0	0	0
Tikchik L.	0	0	0	0	0	0	0	0	0	0	0
Koktuli R.					0	0	0	0 <sup>a</sup>	0	0 <sup>a</sup>	0
Other	0	0	0	0	0	0	0	0	0	0	0
Subtotal	0	0	17	0	0	0	0	0	0	0	0
Western											
Togiak	0 <sup>a</sup>	0	0	0	0	0	0	0	0	0	0
Goodnews	0 <sup>a</sup>	0	0 <sup>a</sup>	0	0	0	0	0	0	0	0
Kanektok	0	0	0	0	0	0	0	0	0	0	0
Arolik										0 <sup>a</sup>	0
Other	0	0	0	0	0	0	0	0	0	0	0
Subtotal	0	0	0	0	0	0	0	0	0	0	0
Northwestern											
Aniak	0 <sup>a</sup>	0	0	0	0	0	0	0	0	0	0
Kisaralik							0	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0
Kwethluk					0	107	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	21
Other	91	0	1,125	40	169	107	10	0	0	0	23
Subtotal	91	0	1,125	40	169	214	10	0	0	0	45
Eastern	18	0	100	53	0	0	10	0	18	147	35
Central	0	0	17	0	0	0	0	0	0	0	0
Western	0	0	0	0	0	0	0	0	0	0	0
Northwestern	91	0	1,125	40	169	214	10	0	0	0	45
Total	109	0	1,242	93	169	214	20	0	18	147	80

Source: Mills 1977-1994, Howe et al. 1995-1998. Unless otherwise noted, these are published estimates for sites which garnered 12 or more responses in the Statewide Harvest Survey.

<sup>a</sup> Unpublished estimates from Statewide Harvest Survey for sites with less than 12 responses.

**Appendix A9.-Sport harvest of smelt from the waters of Southwest Alaska by fishery, 1977-1997.**

Drainage	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Eastern											
Ugashik	0	0	0	0	0	0	0	0	0 <sup>a</sup>	0 <sup>a</sup>	0
Egegik/Becharof	0	0	0	0	0	0	0	873 <sup>a</sup>	175 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>
Naknek R.	6,434	1,077	65,238	30,764	5,778	14,547	3,902	6,986	7,420	1,284	21
Naknek L.	0	0	0	0	0	0	0	0	0 <sup>a</sup>	0	0
Bay of Islands							0	0	0	0 <sup>a</sup>	0
Brooks R.	0	0	0	0	0	0	0	0	0	0	0
Brooks L.											
American Cr.							0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>
King Salmon R.											
Kvichak R.	0	0	0	0	0	0	0	0	0	0	0
Copper R.	0	0	0	0	0	0	0	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>
Alagnak R.					0	0	0	0	0	0	0
Newhalen R.	0	0	0	0	0	0	0	0	0	0	0
L Talarik Cr.	0	0	0	0	0	0	0	0 <sup>a</sup>	0	0 <sup>a</sup>	0 <sup>a</sup>
Lake Clark	0	0	0	0	0	0	0	0	0	0	0
Lake Iliamna							0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0	0
Kulik R.											
Tazimina R.											
Moraine Cr.											
Other							0	0	8,750	0	21
Subtotal	6,434	1,077	65,238	30,764	5,778	14,547	3,902	7,859	16,345	1,284	42

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**Appendix A9.-Page 2 of 4.**

Drainage	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	5-Year Average
Eastern											
Ugashik	0 <sup>a</sup>	0	0	530	0	0	0	0	0	0	0
Egegik/Becharof	0 <sup>a</sup>	0	1,724	398	541	0	3,828	633	0	280	948
Naknek R.	30,321	4,456	1,448	14,321	14,235	2,704	8,653	2,128	0	5,048	3,707
Naknek L.	0 <sup>a</sup>	0	0	0	0	0	0	0	0	0	0
Bay of Islands	0 <sup>a</sup>	0	0	0	0	0	0	0	0	0	0
Brooks R.	0	0	0	0	0	0	0	0	0	0	0
Brooks L.			0	0	0	0	0	0	0	0	0
American Cr.	0 <sup>a</sup>	0	0	0 <sup>a</sup>	0	0	0	0	0	0	0
King Salmon R.					0	0	0	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0
Kvichak R.	0	0	0	0	0	0	0	0	0	0	0
Copper R.	0 <sup>a</sup>	0	0	0	0	0	0	0	0	0	0
Alagnak R.	0 <sup>a</sup>	0	0	0	0	0	0	0	0	0	0
Newhalen R.	0	0	0	0	0	0	0	0	0	0	0
L Talarik Cr.	0 <sup>a</sup>	0 <sup>a</sup>	0	0	0	0	0	0	0	0	0
Lake Clark	0 <sup>a</sup>	0	0	0	0	0	0	0	0	0	0
Lake Iliamna	0	0	0	0	0	0	0	0	0	0	0
Kulik R.					0	0	0	0	0	0	0
Tazimina R.					0	0	0	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0
Moraine Cr.					0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0	0	0
Subtotal	30,321	4,456	3,172	15,249	14,776	2,704	12,481	2,761	0	5,328	4,655

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**Appendix A9.-Page 3 of 4.**

Drainage	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Central											
Nushagak	5,630	757	0	0	0	0	0	0	0	0	46
Mulchatna	0	0	0	0	0	0	0	0	0	0	0
Agulowak											
Agulukpak											
Wood River L.	0	0	0	0	0	0	0	0	0	0	0
Tikchik L.	0	0	0	0	0	0	0	0	0	0 <sup>a</sup>	0 <sup>a</sup>
Koktuli R.											
Other					0	0	0	0	0	0	0
Subtotal	5,630	757	0	0	0	0	0	0	0	0	46
Western											
Togiak	0	0	0	0	0	0	0	0	0 <sup>a</sup>	0	0 <sup>a</sup>
Goodnews							0	0 <sup>a</sup>	0	0 <sup>a</sup>	0 <sup>a</sup>
Kanektok							0	0	0	0	0
Arolik											
Other					0		0	0	0	0	
Subtotal	0	0	0	0	0	0	0	0	0	0	0
Northwestern											
Aniak							0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>
Kisaralik											
Kwethluk											
Other							0	0	1,750	0	0
Subtotal							0	0	1,750	0	0
Eastern	6,434	1,077	65,238	30,764	5,778	14,547	3,902	7,859	16,345	1,284	42
Central	5,630	757	0	0	0	0	0	0	0	0	46
Western	0	0	0	0	0	0	0	0	0	0	0
Northwestern							0	0	1,750	0	0
Total	12,064	1,834	65,238	30,764	5,778	14,547	3,902	7,859	18,095	1,284	88

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Drainage	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	5-Year Average
Central											
Nushagak	0	14,980	1,736	2,946	4,976	0	5,157	1,584	0	0	1,348
Mulchatna	0	0	0	0	0	0	0	0	0	0	0
Agulowak										0 <sup>a</sup>	0
Agulukpak										0 <sup>a</sup>	0
Wood River L.	31	20,568	521	2,970	1,190	2,446	3,232	2,280	0	0	1,592
Tikchik L.	0	0	0	0	0	0	0	0	0	0	0
Koktuli R.					0	0	0	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0
Other	0	13,712	0	0	0	48	0	0	0	2,966	603
Subtotal	31	49,260	2,257	5,916	6,166	2,494	8,389	3,864	0	2,966	3,543
Western											
Togiak	0 <sup>a</sup>	2,571	0	0	0	0	653	887	525	0	413
Goodnews	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0	0	0	0	0	0	0	0
Kanektok	248	0	211	0	0	0	0	633	0	28	132
Arolik										0 <sup>a</sup>	
Other	0	189	0	0	0	0	0	0	0	0	0
Subtotal	248	2,760	211	0	0	0	653	1,520	525	28	545
Northwestern											
Aniak	0 <sup>a</sup>	0	0	0	0	0	2,292	0	0	0	458
Kisaralik							0	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0
Kwethluk					0	1,211	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	242
Other	0	1,135	0	0	1,136	1,049	0	0	0	0	210
Subtotal	0	1,135	0	0	1,136	2,260	2,292	0	0	0	910
Eastern	30,321	4,456	3,172	15,249	14,776	2,704	12,481	2,761	0	5,328	4,655
Central	31	49,260	2,257	5,916	6,166	2,494	8,389	3,864	0	2,966	3,543
Western	248	2,760	211	0	0	0	653	1,520	525	28	545
Northwestern	0	1,135	0	0	1,136	2,260	2,292	0	0	0	910
Total	30,600	57,611	5,640	21,165	22,078	7,458	23,815	8,145	525	8,322	9,653

Source: Mills 1977-1994, Howe et al. 1995-1998. Unless otherwise noted, these are published estimates for sites that garnered 12 or more responses in the Statewide Harvest Survey.

<sup>a</sup> Unpublished estimates from Statewide Harvest Survey for sites with less than 12 responses.



## **APPENDIX B**

**Appendix B1.-Sport catch of chinook salmon from the waters of Southwest Alaska by fishery, 1991-1997.**

Drainage	1991	1992	1993	1994	1995	1996	1997	5-Year Average
<b>Eastern</b>								
Ugashik	403	625	566	1,020	325	1,861	3,476	1,450
Egegik/Becharof	336	1,323	695	239	1,134	1,353	2,281	1,140
Naknek R.	2,314	1,471	3,029	1,539	2,949	1,900	845	2,052
Naknek L.	1,210	764	868	467	408	518	871	626
Bay of Islands	144	419	0	87	89	144	123	89
Brooks R.	3,552	5,515	10,504	1,921	3,699	6,581	5,861	5,713
Brooks L.	490	304	442	271	720	241	100	355
American Cr.	0 <sup>a</sup>	33	642	577	525	530	2,212	897
King Salmon R.		0	506	9	67 <sup>a</sup>	78 <sup>a</sup>	0 <sup>a</sup>	132
Kvichak R.	3,451	4,685	8,961	7,886	6,906	4,974	2,438	6,233
Copper R.	1,720	1,512	7,566	3,167	2,004	1,437	2,677	3,370
Alagnak R.	2,724	6,443	24,650	2,751	7,821	6,241	6,776	9,648
Newhalen R.	24,842	16,117	21,928	15,283	15,324	9,618	8,546	14,140
L Talarik Cr.	287	427	746	559	125	954	137	504
Lake Clark	829	1,693	820	1,088	1,990	313	1,957	1,234
Lake Iliamna	2,171	2,877	7,405	2,272	3,148	2,370	1,902	3,419
Kulik R.		131	165	357	45	631	498	339
Tazimina R.		1,151	116	418	31 <sup>a</sup>	12 <sup>a</sup>	0 <sup>a</sup>	115
Moraine Cr.		164	287	218	134	494	272	281
Other	2,044	2,292	5,792	4,794	2,279	4,379	4,076	4,264
Subtotal	46,517	47,946	95,688	44,923	49,723	44,629	45,048	56,002
<b>Central</b>								
Nushagak	2,720	1,693	2,122	1,202	865	3,905	2,303	2,079
Mulchatna	1,350	1,446	1,898	607	1,211	2,862	1,820	1,680
Agulowak							842 <sup>a</sup>	842
Agulukpak							1,337 <sup>a</sup>	1,337
Wood River L.	6,080	3,590	6,394	3,000	1,836	7,299	2,828	4,271
Tikchik L.	1,480	1,537	6,286	475	267	651	498	1,635
Koktuli		781	980	479	385 <sup>a</sup>	2,499	1,245 <sup>a</sup>	1,118
Other	550	148	1,255	550	283	2,137	2,813	1,408
Subtotal	12,180	9,195	18,935	6,313	4,847	19,353	13,686	12,627
<b>Western</b>								
Togiak	640	140	429	193	499	2,271	1,145	907
Goodnews	2,003	90	321	207	380	1,119	1,625	730
Kanektok	1,147	1,290	1,887	3,622	733	2,157	2,155	2,111
Arolik							1,174 <sup>a</sup>	1,174
Other	0	0	78	0	0	0	6,099	1,235
Subtotal	3,790	1,520	2,715	4,022	1,612	5,547	12,198	5,219
<b>Northwestern</b>								
Aniak	151	74	79	87	166	150	414	179
Kisaralik				452	0 <sup>a</sup>	0 <sup>a</sup>	12 <sup>a</sup>	116
Kwethluk		58	19	0 <sup>a</sup>	0 <sup>a</sup>	248 <sup>a</sup>	0 <sup>a</sup>	53
Other	0	246	377	316	85	480	0	252
Subtotal	151	378	475	855	251	878	426	577
<b>Total</b>	<b>62,638</b>	<b>59,039</b>	<b>117,813</b>	<b>56,113</b>	<b>56,433</b>	<b>70,407</b>	<b>71,358</b>	<b>74,425</b>

Source: Mills 1992-1994, Howe et al. 1995-1998. Unless otherwise noted, these are published estimates for sites that garnered 12 or more responses in the Statewide Harvest Survey.

<sup>a</sup> Unpublished estimates from Statewide Harvest Survey for sites with less than 12 responses.

**Appendix B2.-Sport catch of coho salmon from the waters of Southwest Alaska by fishery, 1991-1997.**

Drainage	1991	1992	1993	1994	1995	1996	1997	5-Year Average
<b>Eastern</b>								
Ugashik	592	1,166	837	1,586	891	1,302	2,215	1,366
Egegik/Becharof	581	842	275	590	546	735	1,472	724
Naknek R.	2,032	2,745	2,187	3,188	3,692	7,228	5,602	4,379
Naknek L.	32	283	67	111	418	0	12	122
Bay of Islands	11	40	19	0	0	0	11	6
Brooks R.	86	429	549	136	1,061	100	640	497
Brooks L.	86	40	153	30	212	40	23	92
American Cr.	0 <sup>a</sup>	0	17	0	0	0	62	16
King Salmon R.		40	506	0	312 <sup>a</sup>	596 <sup>a</sup>	684 <sup>a</sup>	420
Kvichak R.	908	518	863	939	701	611	1,213	865
Copper R.	0	0	0	0	0	0	0	0
Alagnak R.	1,283	2,964	2,358	2,088	1,578	8,166	4,463	3,731
Newhalen R.	499	405	1,066	683	890	20	0	532
L Talarik Cr.	0	24	210	29	77	60	0	75
Lake Clark	102	81	382	0	110	0	0	98
Lake Iliamna	114	49	145	72	500	10	0	145
Kulik R.		0	0	0	0	0	0	0
Tazimina R.		0	0	0	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0
Moraine Cr.		0	0	0	0	0	0	0
Other	1,145	1,012	2,018	1,358	969	1,612	2,656	1,723
Subtotal	7,471	10,638	11,652	10,810	11,957	20,480	19,053	14,790
<b>Central</b>								
Nushagak	863	1,029	1,154	1,735	2,296	7,810	1,377	2,874
Mulchatna	579	470	368	458	826	1,902	758	862
Agulowak							410 <sup>a</sup>	410
Agulukpak							0 <sup>a</sup>	0
Wood River L.	831	1,036	549	1,036	1,195	1,221	1,355	1,071
Tikchik L.	22	32	176	180	0	2,105	758	644
Koktuli R.		0	0	82	0 <sup>a</sup>	734 <sup>a</sup>	0 <sup>a</sup>	163
Other	252	678	351	680	423	1,898	1,504	971
Subtotal	2,547	3,245	2,598	4,171	4,740	15,670	6,162	6,668
<b>Western</b>								
Togiak	547	996	727	1,408	1,268	5,392	3,642	2,487
Goodnews	1,176	1,571	499	456	761	1,375	3,549	1,328
Kanektok	2,404	3,174	3,741	1,322	3,602	5,084	10,871	4,924
Arolik							311 <sup>a</sup>	311
Other	405	0	0	0	0	377	0	75
Subtotal	4,532	5,741	4,967	3,186	5,631	12,228	18,373	8,877
<b>Northwestern</b>								
Aniak	1,432	575	753	852	2,246	3,746	4,100	2,339
Kisaralik				492	274 <sup>a</sup>	2,135 <sup>a</sup>	921 <sup>a</sup>	956
Kwethluk		1,790	566	525 <sup>a</sup>	208 <sup>a</sup>	1,727 <sup>a</sup>	535 <sup>a</sup>	712
Other	307	1,391	2,152	596	1,428	2,504	2,472	1,830
Subtotal	1,739	3,756	3,471	2,465	4,156	10,112	8,028	5,646
<b>Total</b>	<b>16,289</b>	<b>23,380</b>	<b>22,688</b>	<b>20,632</b>	<b>26,484</b>	<b>58,490</b>	<b>51,616</b>	<b>35,982</b>

Source: Mills 1992-1994, Howe et al. 1995-1998. Unless otherwise noted, these are published estimates for sites that garnered 12 or more responses in the Statewide Harvest Survey.

<sup>a</sup> Unpublished estimates from Statewide Harvest Survey for sites with less than 12 responses.

**Appendix B3.-Sport catch of sockeye salmon from the waters of Southwest Alaska by fishery, 1991-1997.**

Drainage	1991	1992	1993	1994	1995	1996	1997	5-Year Average
<b>Eastern</b>								
Ugashik	403	625	566	1,020	325	1,861	3,476	1,450
Egegik/Becharof	336	1,323	695	239	1,134	1,353	2,281	1,140
Naknek R.	2,314	1,471	3,029	1,539	2,949	1,900	845	2,052
Naknek L.	1,210	764	868	467	408	518	871	626
Bay of Islands	144	419	0	87	89	144	123	89
Brooks R.	3,552	5,515	10,504	1,921	3,699	6,581	5,861	5,713
Brooks L.	490	304	442	271	720	241	100	355
American Cr.	0 <sup>a</sup>	33	642	577	525	530	2,212	897
King Salmon R.		0	506	9	67 <sup>a</sup>	78 <sup>a</sup>	0 <sup>a</sup>	132
Kvichak R.	3,451	4,685	8,961	7,886	6,906	4,974	2,438	6,233
Copper R.	1,720	1,512	7,566	3,167	2,004	1,437	2,677	3,370
Alagnak R.	2,724	6,443	24,650	2,751	7,821	6,241	6,776	9,648
Newhalen R.	24,842	16,117	21,928	15,283	15,324	9,618	8,546	14,140
L Talarik Cr.	287	427	746	559	125	954	137	504
Lake Clark	829	1,693	820	1,088	1,990	313	1,957	1,234
Lake Iliamna	2,171	2,877	7,405	2,272	3,148	2,370	1,902	3,419
Kulik R.		131	165	357	45	631	498	339
Tazimina R.		1,151	116	418	31 <sup>a</sup>	12 <sup>a</sup>	0 <sup>a</sup>	115
Moraine Cr.		164	287	218	134	494	272	281
Other	2,044	2,292	5,792	4,794	2,279	4,379	4,076	4,264
Subtotal	46,517	47,946	95,688	44,923	49,723	44,629	45,048	56,002
<b>Central</b>								
Nushagak	2,720	1,693	2,122	1,202	865	3,905	2,303	2,079
Mulchatna	1,350	1,446	1,898	607	1,211	2,862	1,820	1,680
Agulowak							842 <sup>a</sup>	842
Agulupak							1,337 <sup>a</sup>	1,337
Wood River L.	6,080	3,590	6,394	3,000	1,836	7,299	2,828	4,271
Tikchik L.	1,480	1,537	6,286	475	267	651	498	1,635
Koktuli		781	980	479	385 <sup>a</sup>	2,499	1,245 <sup>a</sup>	1,118
Other	550	148	1,255	550	283	2,137	2,813	1,408
Subtotal	12,180	9,195	18,935	6,313	4,847	19,353	13,686	12,627
<b>Western</b>								
Togiak	640	140	429	193	499	2,271	1,145	907
Goodnews	2,003	90	321	207	380	1,119	1,625	730
Kanektok	1,147	1,290	1,887	3,622	733	2,157	2,155	2,111
Arolik							1,174 <sup>a</sup>	1,174
Other	0	0	78	0	0	0	6,099	1,235
Subtotal	3,790	1,520	2,715	4,022	1,612	5,547	12,198	5,219
<b>Northwestern</b>								
Aniak	151	74	79	87	166	150	414	179
Kisaralik				452	0 <sup>a</sup>	0 <sup>a</sup>	12 <sup>a</sup>	116
Kwethluk		58	19	0 <sup>a</sup>	0 <sup>a</sup>	248 <sup>a</sup>	0 <sup>a</sup>	53
Other	0	246	377	316	85	480	0	252
Subtotal	151	378	475	855	251	878	426	577
<b>Total</b>	<b>62,638</b>	<b>59,039</b>	<b>117,813</b>	<b>56,113</b>	<b>56,433</b>	<b>70,407</b>	<b>71,358</b>	<b>74,425</b>

Source: Mills 1992-1994, Howe et al. 1995-1998. Unless otherwise noted, these are published estimates for sites that garnered 12 or more responses in the Statewide Harvest Survey.

<sup>a</sup> Unpublished estimates from Statewide Harvest Survey for sites with less than 12 responses.



**Appendix B4.-Sport catch of pink salmon from the waters of Southwest Alaska by fishery, 1991-1997.**

Drainage	1991	1992	1993	1994	1995	1996	1997	5-Year Average
<b>Eastern</b>								
Ugashik	0	183	0	32	0	297	317	129
Egegik/Becharof	0	18	0	358	169	1,173	264	393
Naknek R.	10	1,814	104	738	214	1,634	125	563
Naknek L.	0	256	0	0	0	0	88	18
Bay of Islands	0	0	0	0	0	0	44	9
Brooks R.	0	101	0	65	469	50	265	170
Brooks L.	0	0	0	16	0	0	0	3
American Cr.	0 <sup>a</sup>	0	9	0	0	0	154	33
King Salmon R.		9	0	43	0 <sup>a</sup>	0 <sup>a</sup>	33 <sup>a</sup>	15
Kvichak R.	300	1,081	9	1,708	66	1,999	64	769
Copper R.	0	0	0	0	0	0	0	0
Alagnak R.	409	13,016	786	975	45	8,387	426	2,124
Newhalen R.	0	0	0	0	0	0	0	0
L Talarik Cr.	0	0	0	0	0	0	0	0
Lake Clark	0	0	0	0	0	0	0	0
Lake Iliamna	0	0	302	51	0	212	0	113
Kulik R.		0	0	0	0	0	0	0
Tazimina R.		0	0	0	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0
Moraine Cr.		0	0	0	0	0	22	4
Other	2,045	1,145	557	450	1,032	795	1,299	827
Subtotal	2,764	17,623	1,767	4,436	1,995	14,547	3,101	5,169
<b>Central</b>								
Nushagak	348	2,629	211	356	341	2,008	105	604
Mulchatna	0	46	43	231	26	119	0	84
Agulowak							0 <sup>a</sup>	0
Agulukpak							0 <sup>a</sup>	0
Wood River L.	202	1,301	29	909	38	198	254	286
Tikchik L.	0	348	0	49	66	569	121	161
Koktuli R.	0	0	0	32	0 <sup>a</sup>	218	0 <sup>a</sup>	50
Other	90	0	36	220	0	30	0	57
Subtotal	640	4,324	319	1,797	471	3,142	480	1,242
<b>Western</b>								
Togiak	11	568	43	365	333	508	110	272
Goodnews	173	431	269	528	28	681	473	396
Kanektok	544	6,971	482	2,598	150	1,731	568	1,106
Arolik							22 <sup>a</sup>	22
Other	0	0	0	0	0	0	0	0
Subtotal	728	7,970	794	3,491	511	2,920	1,173	1,778
<b>Northwestern</b>								
Aniak	0	998	364	388	116	287	33	238
Kisaralik				98	0 <sup>a</sup>	88 <sup>a</sup>	0 <sup>a</sup>	47
Kwethluk		101	0	154 <sup>a</sup>	0 <sup>a</sup>	48 <sup>a</sup>	0 <sup>a</sup>	40
Other	12	761	0	32	9	184	0	45
Subtotal	12	1,860	364	672	125	607	33	360
<b>Total</b>	<b>4,144</b>	<b>31,777</b>	<b>3,244</b>	<b>10,396</b>	<b>3,102</b>	<b>21,216</b>	<b>4,787</b>	<b>8,549</b>

Source: Mills 1992-1994, Howe et al. 1995-1998. Unless otherwise noted, these are published estimates for sites that garnered 12 or more responses in the Statewide Harvest Survey.

<sup>a</sup> Unpublished estimates from Statewide Harvest Survey for sites with less than 12 responses.

**Appendix B5.-Sport catch of chum salmon from the waters of Southwest Alaska by fishery, 1991-1997.**

Drainage	1991	1992	1993	1994	1995	1996	1997	5-Year Average
<b>Eastern</b>								
Ugashik	50	395	100	92	22	1,303	1,144	532
Egegik/Becharof	30	84	0	147	197	413	929	337
Naknek R.	567	517	249	926	950	629	1,440	839
Naknek L.	0	0	0	0	0	0	0	0
Bay of Islands	20	304	0	0	0	0	0	0
Brooks R.	0	23	0	19	0	0	266	57
Brooks L.	0	0	8	0	0	0	0	2
American Cr.	0 <sup>a</sup>	0	0	0	0	0	0	0
King Salmon R.		0	0	29	350 <sup>a</sup>	567 <sup>a</sup>	0 <sup>a</sup>	189
Kvichak R.	1,180	516	573	759	175	523	812	568
Copper R.	0	0	0	0	0	0	0	0
Alagnak R.	5,811	11,677	10,320	4,636	9,978	12,785	11,156	9,775
Newhalen R.	0	0	0	0	0	0	0	0
L Talarik Cr.	0	0	0	0	0	0	0	0
Lake Clark	0	0	0	0	0	0	0	0
Lake Iliamna	0	38	83	10	0	92	168	71
Kulik R.		0	0	0	0	0	0	0
Tazimina R.		0	17	0	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	3
Moraine Cr.		0	0	0	0	0	129	26
Other	220	570	899	110	1,170	2,161	1,448	1,158
Subtotal	7,878	14,124	12,249	6,728	12,842	18,473	17,492	13,557
<b>Central</b>								
Nushagak	1,662	6,544	3,651	7,005	3,581	9,339	3,213	5,358
Mulchatna	457	2,050	2,275	2,223	1,251	3,816	1,653	2,244
Agulowak							103 <sup>a</sup>	103
Agulukpak							0 <sup>a</sup>	0
Wood River L.	310	410	297	133	40	676	432	316
Tikchik L.	46	850	28	327	120	199	13	137
Koktuli R.		296	440	538	18 <sup>a</sup>	1,104	0 <sup>a</sup>	420
Other	401	45	429	1,636	285	769	440	712
Subtotal	2,876	10,195	7,120	11,862	5,295	15,903	5,854	9,207
<b>Western</b>								
Togiak	493	395	906	1,419	2,064	4,489	1,070	1,990
Goodnews	527	402	924	381	315	351	1,049	604
Kanektok	1,382	3,994	4,849	6,386	5,049	8,155	6,732	6,234
Arolik							426 <sup>a</sup>	426
Other	0	0	191	0	0	614	0	161
Subtotal	2,402	4,791	6,870	8,186	7,428	13,609	9,277	9,074
<b>Northwestern</b>								
Aniak	656	1,670	2,412	1,342	2,785	3,888	2,136	2,513
Kisaralik				1,123	44 <sup>a</sup>	1,832 <sup>a</sup>	9 <sup>a</sup>	752
Kwethluk		91	221	183 <sup>a</sup>	90 <sup>a</sup>	930 <sup>a</sup>	57 <sup>a</sup>	296
Other	577	760	926	978	709	1,141	533	857
Subtotal	1,233	2,521	3,559	3,626	3,628	7,791	2,735	4,268
<b>Total</b>	<b>14,389</b>	<b>31,631</b>	<b>29,798</b>	<b>30,402</b>	<b>29,193</b>	<b>55,776</b>	<b>35,358</b>	<b>36,105</b>

Source: Mills 1992-1994, Howe et al. 1995-1998. Unless otherwise noted, these are published estimates for sites that garnered 12 or more responses in the Statewide Harvest Survey.

<sup>a</sup> Unpublished estimates from Statewide Harvest Survey for sites with less than 12 responses.

**Appendix B6.-Sport catch of lake trout from the waters of Southwest Alaska by fishery, 1991-1997.**

Drainage	1991	1992	1993	1994	1995	1996	1997	5-Year Average
<b>Eastern</b>								
Ugashik	222	170	131	121	114	592	898	371
Egegik/Becharof	0	8	9	0	17	0	0	5
Naknek R.	154	93	97	396	74	409	184	232
Naknek L.	205	116	160	140	168	55	67	118
Bay of Islands	358	648	730	392	241	357	285	401
Brooks R.	0	23	224	117	112	0	120	115
Brooks L.	819	609	654	919	583	951	248	671
American Cr.	0 <sup>a</sup>	139	230	165	10	185	0	118
King Salmon R.		0	0	0	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0
Kvichak R.	113	108	202	376	38	137	53	161
Copper R.	0	0	0	66	0	18	0	17
Alagnak R.	495	147	460	119	404	216	172	274
Newhalen R.	353	324	699	610	260	65	113	349
L Talarik Cr.	0	0	0	0	0	0	0	0
Lake Clark	904	1,619	2,121	2,472	721	216	303	1,167
Lake Iliamna	155	409	811	720	88	152	26	359
Kulik R.		8	424	132	133	219	0	182
Tazimina R.		8	18	550	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	114
Moraine Cr.		23	19	221	7	36	0	57
Other	1,266	2,475	2,984	3,181	559	856	542	1,624
Subtotal	5,044	6,927	9,973	10,697	3,529	4,464	3,011	6,335
<b>Central</b>								
Nushagak	34	231	144	184	17	161	13	104
Mulchatna	0	23	0	204	9	9	103	65
Agulowak							0 <sup>a</sup>	0
Agulukpak							0 <sup>a</sup>	0
Wood River L.	0	15	106	44	0	9	146	61
Tikchik L.	2,043	1,072	1,764	3,305	1,089	1,160	1,868	1,837
Koktuli R.		0	0	0	0 <sup>a</sup>	0	0 <sup>a</sup>	0
Other	292	108	37	308	424	135	310	243
Subtotal	2,369	1,449	2,051	4,045	1,539	1,474	2,440	2,310
<b>Western</b>								
Togiak	137	162	0	148	198	89	0	87
Goodnews	388	15	294	382	38	283	227	245
Kanektok	0	46	18	972	90	182	184	289
Arolik							0 <sup>a</sup>	0
Other	0	0	0	0	0	0	120	24
Subtotal	525	223	312	1,502	326	554	531	645
<b>Northwestern</b>								
Aniak	0	555	10	0	163	54	67	59
Kisaralik				59	0 <sup>a</sup>	111 <sup>a</sup>	43 <sup>a</sup>	53
Kwethluk		0	0	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0
Other	517	810	340	294	152	53	594	287
Subtotal	517	1,365	350	353	315	218	704	388
<b>Total</b>	<b>8,455</b>	<b>9,964</b>	<b>12,686</b>	<b>16,597</b>	<b>5,709</b>	<b>6,710</b>	<b>6,686</b>	<b>9,678</b>

Source: Mills 1992-1994, Howe et al. 1995-1998. Unless otherwise noted, these are published estimates for sites that garnered 12 or more responses in the Statewide Harvest Survey.

<sup>a</sup> Unpublished estimates from Statewide Harvest Survey for sites with less than 12 responses.

**Appendix B7.-Sport catch of Dolly Varden/Arctic char from the waters of Southwest Alaska by fishery, 1991-1997.**

Drainage	1991	1992	1993	1994	1995	1996	1997	5-Year Average
<b>Eastern</b>								
Ugashik	1,711	499	3,288	3,951	1,309	2,420	3,487	2,891
Egegik/Becharof	359	5,260	3,723	1,604	1,339	831	5,121	2,524
Naknek R.	1,076	3,490	4,727	2,409	2,437	2,865	1,830	2,854
Naknek L.	469	33	1,238	1,205	616	1,034	294	877
Bay of Islands	290	729	232	172	76	521	46	209
Brooks R.	14	172	1,166	716	200	766	928	755
Brooks L.	0	459	78	27	77	20	0	40
American Cr.	2,305 <sup>a</sup>	4,654	9,855	4,158	5,704	2,024	4,596	5,267
King Salmon R.		107	19	206	198 <sup>a</sup>	142 <sup>a</sup>	48 <sup>a</sup>	123
Kvichak R.	676	426	572	810	358	622	2,211	915
Copper R.	1,351	598	1,048	332	471	486	1,045	676
Alagnak R.	1,250	1,802	2,527	935	1,855	3,247	3,475	2,408
Newhalen R.	1,030	1,147	1,658	1,672	1,607	791	1,557	1,457
L Talarik Cr.	220	115	465	0	0	49	0	103
Lake Clark	659	533	484	688	385	137	1,279	595
Lake Iliamna	321	844	982	1,721	356	783	538	876
Kulik R.		860	0	334	0	39	24	79
Tazimina R.		238	336	476	426 <sup>a</sup>	176 <sup>a</sup>	469 <sup>a</sup>	377
Moraine Cr.		90	132	318	19	40	23	106
Other	6,264	3,910	11,196	7,872	7,484	4,945	6,341	7,568
Subtotal	17,995	25,966	43,726	29,606	24,917	21,938	33,312	30,700
<b>Central</b>								
Nushagak	5,825	4,736	7,632	3,771	3,351	8,422	6,430	5,921
Mulchatna	940	639	923	717	1,376	1,354	1,177	1,109
Agulowak							3,096 <sup>a</sup>	3,096
Agulukpak							2,104 <sup>a</sup>	2,104
Wood River L.	15,764	16,222	13,787	13,960	13,445	11,444	7,607	12,049
Tikchik L.	2,259	2,384	5,867	3,854	2,013	2,453	2,329	3,303
Koktuli R.		672	44	404	299 <sup>a</sup>	963	120 <sup>a</sup>	366
Other	1,019	458	1,091	1,297	965	1,691	2,157	1,440
Subtotal	25,807	25,111	29,344	24,003	21,449	26,327	25,020	25,229
<b>Western</b>								
Togiak	823	1,008	1,030	3,368	3,156	3,049	2,306	2,582
Goodnews	9,936	5,694	8,156	3,156	2,336	4,352	11,585	5,917
Kanektok	10,757	3,990	10,136	8,270	6,231	13,954	24,258	12,570
Arolik							805 <sup>a</sup>	805
Other	0	0	395	0	0	69	36	100
Subtotal	21,516	10,692	19,717	14,794	11,723	21,424	38,990	21,330
<b>Northwestern</b>								
Aniak	3,514	3,736	9,340	3,115	3,454	4,883	15,363	7,231
Kisaralik				2,283	1,667 <sup>a</sup>	1,367 <sup>a</sup>	4,082 <sup>a</sup>	2,350
Kwethluk		57	349	251 <sup>a</sup>	131 <sup>a</sup>	919 <sup>a</sup>	206 <sup>a</sup>	371
Other	1,873	2,179	6,024	908	3,167	2,133	2,804	3,007
Subtotal	5,387	5,972	15,713	6,557	8,419	9,302	22,455	12,489
<b>Total</b>	<b>70,705</b>	<b>67,741</b>	<b>108,500</b>	<b>74,960</b>	<b>66,508</b>	<b>78,991</b>	<b>119,777</b>	<b>89,747</b>

Source: Mills 1992-1994, Howe et al. 1995-1998. Unless otherwise noted, these are published estimates for sites that garnered 12 or more responses in the Statewide Harvest Survey.

<sup>a</sup> Unpublished estimates from Statewide Harvest Survey for sites with less than 12 responses.

**Appendix B8.-Sport catch of Arctic grayling from the waters of Southwest Alaska by fishery, 1991-1997.**

Drainage	1991	1992	1993	1994	1995	1996	1997	5-Year Average
<b>Eastern</b>								
Ugashik	337	518	568	889	1,263	2,968	1,976	1,533
Egegik/Becharof	637	1,082	1,265	740	1,118	347	3,046	1,303
Naknek R.	2,479	2,630	4,158	3,212	1,974	2,278	1,632	2,651
Naknek L.	104	113	280	429	0	93	166	194
Bay of Islands	143	150	54	57	0	0	0	22
Brooks R.	299	977	1,227	2,081	734	1,191	2,012	1,449
Brooks L.	0	75	9	0	9	0	0	4
American Cr.	39 <sup>a</sup>	286	177	418	0	814	100	302
King Salmon R.		30	37	0	122 <sup>a</sup>	19 <sup>a</sup>	285 <sup>a</sup>	93
Kvichak R.	5,205	4,643	4,729	7,497	2,180	3,575	7,595	5,115
Copper R.	77	240	420	398	461	347	938	513
Alagnak R.	7,563	5,673	11,280	7,608	7,235	7,952	5,706	7,956
Newhalen R.	3,905	3,020	4,636	4,477	4,554	3,983	7,146	4,959
L Talarik Cr.	949	301	846	296	395	224	425	437
Lake Clark	4,379	3,404	4,435	4,993	2,371	3,121	6,237	4,231
Lake Iliamna	15	346	594	2,364	497	703	428	917
Kulik R.		0	0	0	0	94	71	33
Tazimina R.		3,088	2,740	3,180	1,273 <sup>a</sup>	722 <sup>a</sup>	907 <sup>a</sup>	1,764
Moraine Cr.		248	897	655	307	487	299	529
Other	10,787	3,871	5,634	4,835	2,159	4,112	7,225	4,793
Subtotal	36,918	30,695	43,986	44,129	26,652	33,030	46,194	38,798
<b>Central</b>								
Nushagak	9,147	7,243	12,746	6,988	7,672	17,154	12,026	11,317
Mulchatna	2,067	2,772	4,325	2,821	5,504	5,299	7,019	4,994
Agulowak							3,292 <sup>a</sup>	3,292
Agulukpak							3,743 <sup>a</sup>	3,743
Wood River L.	9,785	3,818	7,498	5,765	8,017	6,240	5,076	6,519
Tikchik L.	3,611	5,131	11,013	6,476	3,902	10,042	12,253	8,737
Koktuli R.		594	2,211	1,685	1,246 <sup>a</sup>	3,430	3,175 <sup>a</sup>	2,349
Other	6,712	3,140	2,284	4,087	4,165	4,891	10,799	5,245
Subtotal	31,322	22,698	40,077	27,822	30,506	47,056	57,383	40,569
<b>Western</b>								
Togiak	156	579	1,452	1,323	873	1,528	442	1,124
Goodnews	461	609	851	1,813	544	941	2,692	1,368
Kanektok	3,092	391	2,727	1,599	1,128	2,960	8,794	3,442
Arolik							257 <sup>a</sup>	257
Other	0	0	109	0	0	0	0	22
Subtotal	3,709	1,579	5,139	4,735	2,545	5,429	12,185	6,007
<b>Northwestern</b>								
Aniak	4,841	3,855	5,580	2,022	2,266	5,102	22,886	7,571
Kisaralik				1,920	70 <sup>a</sup>	1,300 <sup>a</sup>	3,145 <sup>a</sup>	1,609
Kwethluk	0	120	165	212 <sup>a</sup>	132 <sup>a</sup>	1,065 <sup>a</sup>	365 <sup>a</sup>	388
Other	2,236	3,293	5,948	1,123	4,119	2,973	2,976	3,428
Subtotal	7,077	7,268	11,693	5,277	6,587	10,440	29,372	12,674
<b>Total</b>	<b>79,026</b>	<b>62,240</b>	<b>100,895</b>	<b>81,963</b>	<b>66,290</b>	<b>95,955</b>	<b>145,134</b>	<b>98,047</b>

Source: Mills 1992-1994, Howe et al. 1995-1998. Unless otherwise noted, these are published estimates for sites that garnered 12 or more responses in the Statewide Harvest Survey.

<sup>a</sup> Unpublished estimates from Statewide Harvest Survey for sites with less than 12 responses.

**Appendix B9.-Sport catch of whitefish from the waters of Southwest Alaska by fishery, 1991-1997.**

Drainage	1991	1992	1993	1994	1995	1996	1997	5-Year Average
<b>Eastern</b>								
Ugashik	0	9	0	48	0	0	0	10
Egegik/Becharof	0	0	0	29	0	0	0	6
Naknek R.	40	64	505	0	137	0	42	137
Naknek L.	0	0	0	0	0	0	0	0
Bay of Islands	40	0	0	0	0	0	0	0
Brooks R.	0	0	8	0	0	9	0	3
Brooks L.	0	0	0	0	0	0	0	0
American Cr.	0 <sup>a</sup>	0	9	0	0	0	0	2
King Salmon R.		0	0	0	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0
Kvichak R.	0	138	152	165	27	49	0	79
Copper R.	0	9	0	0	9	0	0	2
Alagnak R.	0	9	221	24	92	274	424	207
Newhalen R.	306	37	0	97	64	98	21	56
L Talarik Cr.	68	46	0	0	0	0	100	20
Lake Clark	986	175	151	19	247	10	0	85
Lake Iliamna	170	28	25	0	0	0	0	5
Kulik R.		0	8	0	0	10	0	4
Tazimina R.		0	0	0	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0
Moraine Cr.		0	31	0	0	0	0	6
Other	0	18	60	118	83	39	0	60
Subtotal	1,610	533	1,170	500	659	489	587	681
<b>Central</b>								
Nushagak	279	662	412	594	198	357	50	322
Mulchatna	0	83	87	0	0	0	0	17
Agulowak							0 <sup>a</sup>	0
Agulukpak							0 <sup>a</sup>	0
Wood River L.	70	18	43	85	18	20	300	93
Tikchik L.	0	46	17	7	0	35	0	12
Koktuli R.		0	0	0	0 <sup>a</sup>	20	0 <sup>a</sup>	4
Other	175	0	9	10	0	0	21	8
Subtotal	524	809	568	696	216	432	371	544
<b>Western</b>								
Togiak	0	0	0	10	0	196	50	51
Goodnews	0	9	16	7	0	0	42	13
Kanektok	61	0	102	52	36	80	185	91
Arolik							0 <sup>a</sup>	0
Other	0	0	0	0	0	0	0	0
Subtotal	61	9	118	69	36	276	277	155
<b>Northwestern</b>								
Aniak	134	0	0	329	27	20	350	145
Kisaralik				0	0 <sup>a</sup>	0 <sup>a</sup>	21 <sup>a</sup>	5
Kwethluk		0	0	0 <sup>a</sup>	0 <sup>a</sup>	10 <sup>a</sup>	0 <sup>a</sup>	2
Other	134	285	190	26	0	27	42	57
Subtotal	268	285	190	355	27	57	413	208
<b>Total</b>	<b>2,463</b>	<b>1,636</b>	<b>2,046</b>	<b>1,620</b>	<b>938</b>	<b>1,254</b>	<b>1,648</b>	<b>1,501</b>

Source: Mills 1992-1994, Howe et al. 1995-1998. Unless otherwise noted, these are published estimates for sites that garnered 12 or more responses in the Statewide Harvest Survey.

<sup>a</sup> Unpublished estimates from Statewide Harvest Survey for sites with less than 12 responses.

**Appendix B10.-Sport catch of northern pike from the waters of Southwest Alaska by fishery, 1991-1997.**

Drainage	1991	1992	1993	1994	1995	1996	1997	5-Year Average
<b>Eastern</b>								
Ugashik	62	60	880	938	150	586	353	581
Egegik/Becharof	0	51	0	0	0	39	125	33
Naknek R.	31	325	252	2,084	160	393	33	584
Naknek L.	289	342	160	134	50	372	47	153
Bay of Islands	227	1,093	2,663	869	547	1,380	721	1,236
Brooks R.	0	0	0	0	0	0	0	0
Brooks L.	0	17	0	0	0	78	0	16
American Cr.	0 <sup>a</sup>	0	169	0	0	231	0	80
King Salmon R.		0	0	0	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0
Kvichak R.	408	649	366	767	490	346	707	535
Copper R.	0	51	228	0	100	0	0	66
Alagnak R.	342	846	347	83	241	1,213	609	499
Newhalen R.	33	17	0	9	111	88	63	54
L Talarik Cr.	228	0	0	0	11	0	0	2
Lake Clark	1,516	777	1,116	1,992	502	409	572	918
Lake Iliamna	33	342	1,134	65	387	120	374	416
Kulik R.		0	0	37	0	0	0	7
Tazimina R.		0	0	0	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0
Moraine Cr.		0	0	0	0	0	0	0
Other	768	1,124	981	812	708	546	984	806
Subtotal	3,937	5,694	8,296	7,790	3,457	5,801	4,588	5,986
<b>Central</b>								
Nushagak	2,071	5,970	3,551	1,831	2,325	2,836	1,158	2,340
Mulchatna	216	512	227	453	318	188	176	272
Agulowak							0 <sup>a</sup>	0
Agulukpak							0 <sup>a</sup>	0
Wood River L.	4,457	5,134	1,447	1,787	3,216	3,043	1,985	2,296
Tikchik L.	475	461	162	571	965	724	1,387	762
Koktuli R.		154	0	90	0 <sup>a</sup>	181	22 <sup>a</sup>	59
Other	1,553	514	9	551	436	858	604	492
Subtotal	8,772	12,745	5,396	5,283	7,260	7,830	5,332	6,220
<b>Western</b>								
Togiak	0	26	193	138	238	38	25	126
Goodnews	0	0	0	54	0	0	0	11
Kanektok	0	145	56	0	0	0	52	22
Arolik							0 <sup>a</sup>	0
Other	0	0	0	0	0	0	0	0
Subtotal	0	171	249	192	238	38	77	159
<b>Northwestern</b>								
Aniak	1,448	794	45	698	623	399	512	455
Kisaralik				18	69 <sup>a</sup>	423 <sup>a</sup>	188 <sup>a</sup>	175
Kwethluk		231	526	358 <sup>a</sup>	805 <sup>a</sup>	317 <sup>a</sup>	315 <sup>a</sup>	464
Other	976	1,634	1,088	905	853	1,136	630	922
Subtotal	2,424	2,659	1,659	1,979	2,350	2,275	1,645	1,982
<b>Total</b>	<b>15,133</b>	<b>21,269</b>	<b>15,600</b>	<b>15,244</b>	<b>13,305</b>	<b>15,944</b>	<b>11,642</b>	<b>14,347</b>

Source: Mills 1992-1994, Howe et al. 1995-1998. Unless otherwise noted, these are published estimates for sites that garnered 12 or more responses in the Statewide Harvest Survey.

<sup>a</sup> Unpublished estimates from Statewide Harvest Survey for sites with less than 12 responses.

**Appendix B11.-Sport catch of burbot from the waters of Southwest Alaska by fishery, 1991-1997.**

Drainage	1991	1992	1993	1994	1995	1996	1997	5-Year Average
<b>Eastern</b>								
Ugashik	0	0	0	0	0	0	0	0
Egegik/Becharof	0	0	0	0	0	0	0	0
Naknek R.	0	0	0	0	0	0	0	0
Naknek L.	0	0	0	0	0	0	0	0
Bay of Islands	0	0	0	0	0	0	0	0
Brooks R.	0	0	0	0	0	0	0	0
Brooks L.	0	0	0	0	0	0	0	0
American Cr.	0 <sup>a</sup>	0	0	0	0	0	0	0
King Salmon R.		0	0	0	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0
Kvichak R.	0	0	0	0	0	0	0	0
Copper R.	0	0	0	0	0	0	0	0
Alagnak R.	0	0	0	0	0	0	0	0
Newhalen R.	0	0	0	0	0	0	0	0
L Talarik Cr.	0	0	0	0	0	0	0	0
Lake Clark	53	0	107	0	0	18	147	54
Lake Iliamna	0	0	0	0	0	0	0	0
Kulik R.		0	0	0	0	0	0	0
Tazimina R.		0	0	0	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0
Moraine Cr.		0	0	0	0	0	0	0
Other	0	0	0	10	0	0	0	2
Subtotal	53	0	107	10	0	18	147	56
<b>Central</b>								
Nushagak	0	0	0	0	0	0	0	0
Mulchatna	0	0	0	0	0	0	0	0
Agulowak							0 <sup>a</sup>	0
Agulukpak							0 <sup>a</sup>	0
Wood River L.	0	0	0	0	0	0	0	0
Tikchik L.	0	0	0	0	0	0	0	0
Koktuli R.		0	0	0	0 <sup>a</sup>	0	0 <sup>a</sup>	0
Other	0	0	0	0	0	0	0	0
Subtotal	0	0	0	0	0	0	0	0
<b>Western</b>								
Togiak	0	0	0	0	0	0	0	0
Goodnews	0	0	0	0	0	0	0	0
Kanektok	0	0	0	0	0	0	0	0
Arolik							0 <sup>a</sup>	0
Other	0	0	0	0	0	0	0	0
Subtotal	0	0	0	0	0	0	0	0
<b>Northwestern</b>								
Aniak	0	0	0	0	0	0	0	0
Kisaralik				0	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0
Kwethluk		0	107	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	147 <sup>a</sup>	51
Other	50	169	107	10	0	0	0	23
Subtotal	50	169	214	10	0	0	147	74
<b>Total</b>	<b>103</b>	<b>169</b>	<b>321</b>	<b>20</b>	<b>0</b>	<b>18</b>	<b>294</b>	<b>131</b>

Source: Mills 1992-1994, Howe et al. 1995-1998. Unless otherwise noted, these are published estimates for sites that garnered 12 or more responses in the Statewide Harvest Survey.

<sup>a</sup> Unpublished estimates from Statewide Harvest Survey for sites with less than 12 responses.



**Appendix B12.-Sport catch of smelt from the waters of Southwest Alaska by fishery, 1991-1997.**

Drainage	1991	1992	1993	1994	1995	1996	1997	5-Year Average
<b>Eastern</b>								
Ugashik	530	97	0	0	0	0	0	0
Egegik/Becharof	398	541	0	3,828	633	0	280	948
Naknek R.	14,321	15,609	2,769	8,664	2,128	0	5,048	3,722
Naknek L.	0	0	0	0	0	0	0	0
Bay of Islands	0	0	0	0	0	0	0	0
Brooks R.	0	0	0	0	0	0	0	0
Brooks L.	0	0	0	0	0	0	0	0
American Cr.	0 <sup>a</sup>	0	0	0	0	0	0	0
King Salmon R.		0	0	0	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0
Kvichak R.	0	0	0	0	0	0	0	0
Copper R.	0	0	0	0	0	0	0	0
Alagnak R.	0	0	0	0	0	0	0	0
Newhalen R.	0	0	0	0	0	0	0	0
L Talarik Cr.	0	0	0	0	0	0	0	0
Lake Clark	0	0	0	0	0	0	0	0
Lake Iliamna	0	0	0	0	0	0	0	0
Kulik R.		0	0	0	0	0	0	0
Tazimina R.		0	0	0	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0
Moraine Cr.		0	0	0	0	0	0	0
Other	0	0	22	0	0	0	0	4
Subtotal	15,249	16,247	2,791	12,492	2,761	0	5,328	4,674
<b>Central</b>								
Nushagak	2,946	4,997	0	6,303	1,584	0	0	1,577
Mulchatna	0	541	0	0	0	0	0	0
Agulowak							0 <sup>a</sup>	0
Agulupak							0 <sup>a</sup>	0
Wood River L.	2,970	1,623	2,446	3,301	2,280	0	0	1,605
Tikchik L.	0	0	0	0	0	0	0	0
Koktuli R.		0	0	0	0 <sup>a</sup>	0	0 <sup>a</sup>	0
Other	0	0	48	0	0	0	2,966	603
Subtotal	5,916	7,161	2,494	9,604	3,864	0	2,966	3,786
<b>Western</b>								
Togiak	0	0	0	653	887	525	0	413
Goodnews	0	0	0	0	0	0	0	0
Kanektok	0	0	0	0	633	0	280	183
Arolik							0 <sup>a</sup>	0
Other	0	0	0	0	0	0	0	0
Subtotal	0	0	0	653	1,520	525	280	596
<b>Northwestern</b>								
Aniak	0	0	0	2,292	0	0	0	458
Kisaralik				0	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0
Kwethluk		0	1,211	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>	242
Other	0	1,136	1,049	0	0	0	0	210
Subtotal	0	1,136	2,260	2,292	0	0	0	910
<b>Total</b>	<b>21,165</b>	<b>24,544</b>	<b>7,545</b>	<b>25,041</b>	<b>8,145</b>	<b>525</b>	<b>8,574</b>	<b>9,966</b>

Source: Mills 1992-1994, Howe et al. 1995-1998. Unless otherwise noted, these are published estimates for sites that garnered 12 or more responses in the Statewide Harvest Survey.

<sup>a</sup> Unpublished estimates from Statewide Harvest Survey for sites with less than 12 responses.